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A study on creating a user-centered wellness design evaluation tool for healthcare design: focusing on the analysis of user's experience in the main lobby of a healthcare facility

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A study on creating a user-centered wellness design evaluation tool for healthcare design: Focusing on the analysis of user's experience in the main lobby of a healthcare facility

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ABSTRACT

The goal of this study is to create an evidence-based evaluation tool for a healthcare facility's main entry lobby that will improve the physical, emotional, and social experiences of users. A combination of content analysis and an online survey was used to create valid evaluation criteria for the design of a healthcare facility's main entry lobby. Relevant theories and literature were reviewed to better understand the concept of wellness and design issues that could affect a user's wellness within a healthcare environment. Five wellness design criteria were identified: 1. user experience, 2. positive distractions, 3. sense of control, 4. social interaction, and 5. safety and security. These criteria served as the major standards for developing the wellness design tool. The thesis used a mixed method that combined quantitative and qualitative methods of content analysis. Using the qualitative method, six existing healthcare evaluation tools and design guidelines were investigated, identifying twenty different wellness design features and their details. The quantitative method, explored how users of a healthcare facility perceived the selected wellness design features after their visit to the healthcare lobby. An online survey was administered in Iowa for 275 participants. Results of the questionnaire indicated that enhancement of safety and security was the most important consideration in designing a healthcare facility's main entry lobby for improving users' overall wellness experience, while providing optimal positive distractions was the most important consideration with respect to promoting users' emotional wellness experience. Due to the limitation of study using a majority of local and domestic participants, the results did not represent the U.S population. However, the study provided a framework

for creating and validating wellness design evaluation criteria as a design tool for future research.

CHAPTER I

INTRODUCTION

Statement of the Problem

The design of healthcare facilities has most often been focused on functional efficiency of the space, and this focus has often produced psychologically difficult facilities that usually fail if they are stressful or unsuited to the psychological needs of users (Ulrich, 1991). The design should therefore strive to meet the psychological needs of patients, visitors, and staff, because poor design can result in patient negative responses such as anxiety, elevated blood pressure, and increased need for drugs to relieve pain (Ulrich, 1991). According to Bedner (2013) a health facility's main lobby is an important place for design focus because such a space can generate a memorable and positive experience (Pangrazio, 2013).

The experience in the main entry is critical for the branding of a healthcare facility (Malkin, 1991). The main entry lobby of a healthcare facility provides the patients' and visitors' introduction to the facility, and the design of this space can affect expectations for the quality of clinical care offered by the facility (Malkin, 1991). This public space is a place where people can not only spend significant amounts of time to wait for their treatments, but can also spend time engaged in such activities as talking with family members and friends, sharing their emotions, allowing children to play, taking a break from care for their loved ones, and obtaining social support from the community (Bamborough, 2013; Silvis, 2014). While the lobby space has been viewed as a vital element in the overall healthcare experience (Pangrazio, 2013), little research has focused on the influence of a user's wellness experience

related to public spaces in healthcare environments, including both patients' and visitors' experience in the main lobby. Although research-based design has been extensively directed toward patient and staff areas of clinical space, with a focus on wellness concepts, a user's experience could be better defined and understood through facility evaluation using evidence-based design decisions and recommendations. (Silvis, 2014; Ulrich, 1991).

Significance/Reason for the Study

This research focuses on developing a set of design evaluation criteria for applying the wellness concept in the main entry lobby of a healthcare facility. The physical, emotional, and social well-being of patients, visitors and staff during their visits to such a facility will all be considered. This research introduces evidence-based design evaluation criteria for the main entry lobby of a healthcare facility that will support the wellness experience of patients, family members, and the community. It demonstrates how such newly-developed evaluation criteria can be used to assess the development of the design and can serve as a design tool for facility managers and designers in incorporating users' wellness experiences into healthcare environments. Wellness-based design evaluation criteria can contribute to wellness assessment of users, including patients, visitors, families and staff. It would allow healthcare providers and facility planners to have an opportunity to rethink public space design, and interior designers and architects can use the criteria to seek research-based solutions that positively contribute to wellness experience in a healthcare setting. The researcher thus expects improved health outcomes for visitors through use of the newly-developed criteria during the phases of planning, programming, designing and developing wellness design in the main entry lobby of a healthcare facility.

Purpose of the Study

The aim of this research is to:

1. Create user-centered wellness design evaluation criteria that can be used to develop and evaluate either existing facility designs or design of new construction of the main entry lobby of a healthcare facility.
2. Develop and validate a set of wellness design tool, and wellness design guideline and checklists to support design decision-making by designers and facility managers of healthcare facilities.

Research Questions

The researcher hypothesizes that user-centered wellness-oriented design evaluation criteria for the main entry lobby of a healthcare facility can promote an awareness of public wellness. Questions to be answered are:

1. What wellness design criteria could be addressed and which design features should be assessed for evaluating user-centered wellness design experience in the main entry lobby of a healthcare facility?
2. How important are the design features with respect to user experience and how can they impact a user's perception of physical well-being, emotional health, and social interaction in the main entry lobby of a healthcare facility?
3. How do various user groups with differing demographics in terms of gender, students vs. non-students, domestic vs. international background, and their visiting patterns such as use of inpatient facilities vs. outpatient facilities, length

of stay, and frequency of visit, experience the concept of wellness in the main entry lobby of a healthcare facility?

Scope of the Study

The main entry lobby of a healthcare facility typically includes the following elements:

1. Entrance - exterior space, covered wheelchair storage area, valet area for drop-off/ pick-up.
2. Entry vestibule - waiting area, view of drop-off / pick-up area.
3. Main lobby and welcome area - public circulation corridors, special event area, waiting area, welcome desk, information kiosk, public restrooms (male, female, family), multipurpose room (respite, lactation), cash machine alcove, etc.

Limitations of the Study

First, due to the financial and time limitations, the research involves only a group of students in a mid-western campus town in Iowa, so to generalize the design evaluation criteria for nationwide application, the population would need to represent a more varied geographic set of locations and backgrounds. Second, the new design evaluation criteria are developed with sole emphasis on user experience, and it is risky to represent the criteria as measuring all aspects of evaluating occupancy of the main lobby of a healthcare facility. Other aspects to be considered include technical testing of both architectural and interior elements and various methods of evaluation such as interviewing people, behavioral

observation, or tracing measures. The design evaluation criteria should thus be combined with other methods to evaluate a space. Third, due to limited access to references and matters of time, the study involves the analysis of only six evaluation tools and design guidelines, so identifying and reviewing additional resources are suggested by the literature review. A certain degree of subjectivity can also be found in analysis and the assessment of references by the researcher. Finally, the survey has been conducted through an online survey implying that accessibility to and familiarity with the Internet are required for participation in the survey.

Definitions of Terms

Active design: is environmental design that encourages stair climbing, walking, bicycling, transit use, active recreation, and healthy eating (Active design guidelines, 2010).

Evidence-based design: is the process of design of built environments with credible research to achieve the best outcomes of the design (The Center for Health Design, 2009).

Evaluation: is a precise determination of a subject's worth, using criteria with a set of standards. It can help a project, an organization, a program, or any other interventions. Initiative to assess any aim, realizable concept/proposal, or any alternative, to ascertain the degree of achievement or value regarding the purpose and objectives and results of any such action that have been completed (International Alliance for Responsible Drinking, n.d.).

Evaluation criteria: Standard measures established to evaluate the degree to which alternative solution, proposals, or individuals can meet expectations or objectives through direct comparisons of their strengths, weakness, and trade-offs (What is Evaluation Criteria? definition and meaning, n.d.).

Guideline: is a general rule, principle, piece of advice, or a statement by which to determine a course of action. A guideline aims to streamline particular processes according to a set routine or sound practice. By definition, following a guideline is never mandatory (Oxford dictionaries; U.S. Dept. of Veterans Affairs).

Healing environment: is the overall both physical and non-physical environment that created to aid the recovery process (Abbas & Ghazaliky., 2010).

Health: is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity (World Health Organization, 1948). It is more than freedom from disease and illness, though protection against disease is essential to good health. Optimal health includes high-level emotional, social, spiritual and physical wellness within the limits of one's heredity and personal abilities. Optimal well-being contributes to one's quality of life.

Healthcare facilities: are places that provide health care. It is any organized institution devoted to health service that provides medical intervention for diagnosis, treatment, and care, whatever its mission, size, or program. Healthcare facilities exist solely to provide services in response to health needs (Preiser, 1978). They include hospitals, clinics, outpatient care center, and specialized care centers, such as birthing centers and psychiatric care center (MedlinePlus).

Health-Related Quality of Life: is a person's or group's perceived physical, mental, emotional, and social health over time (CDC).

Main Entry Lobby: is a room in a building used for entry from the outside. Sometimes referred to as a foyer or an entrance hall, it often is a large, vast room or complex of rooms.

Patient perceived quality of care: is heavily defined by the amount of empathy, warmth, and friendliness that the patient experiences. This seems to be observable not only positive interactions between the staff and patient but also between the patient and environment as well (Arneill & Devlin, 2002).

Perception: is awareness of something through the sense. A way of regarding, understanding or interpreting something (Oxford dictionaries).

POE of healthcare design: (Post Occupancy Evaluation) is the process of obtaining feedback on a building's performance in use. In 2001, the Federal Facilities Council defined post-occupancy evaluation as a process of systematically assessing the performance of buildings after they built and occupied in that it focuses on requirements of building occupants, including their health, safety, security functionality and efficiency, psychological comfort, aesthetic quality, and satisfaction (Federal Facilities Council, 2002). POE is valuable in human related, especially, commercial, healthcare, education, offices, and housing, occupant well-being, and business efficiency (BUE group).

Population health: is health outcomes of a group of individuals, including the distribution of such outcomes within the group (Kindig, 2007). This is the science of improving and protecting the health of communities through enhancement of healthy lifestyles, research for disease and injury prevention and detection and control of infectious diseases. Public health is concerned with protecting the health of entire population (CDC, n.d.).

Supportive design: is a theory that an environmental design will likely support coping with stress and thereby promote wellness if the designer aims to foster. They are a

sense of control over physical-social surroundings, access to social support, and access to positive distractions in physical surroundings (Ulrich, 1991).

User-Centered Design: is a term to describe design processes in which end-users influence how a design take shape. The important concept of User-Centered Design is that users are involved one way or another in the design processes (Abras et al., 2010).

Well-being: is defined as a sustained healthy physical and mental state over time in a supportive material and social environment. "Well-being is about the combination of our love for what we do each day, the quality of our relationships, the security of our finances, the vibrancy of our physical health, and the pride we take in what we have contributed to our communities" (Frey & Stutzer, 2010; Rath et al., 2010, p.4).

Wellness: is a conscious, self-directed and evolving process of achieving full potential. This concept is a multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment. It is positive and affirming (National Wellness Institute, n.d.).

CHAPTER II

LITERATURE REVIEW

Objectives

The objective of this research is to propose user-centered wellness design evaluation criteria that can be used in developing and evaluating either the design of an existing facility or the new construction of the main entry lobby of a healthcare facility. This proposal is developed based on a literature review about wellness concepts and wellness design issues in healthcare settings. User perceptions of wellness in healthcare environments and wellness experience in such lobbies are further explored. Existing standards and guidelines for healthcare facility design will be reviewed in this chapter.

Wellness Concept

Definition of health, well-being, and wellness

In this section, the three different terms of health, well-being, and wellness are defined to understand how these terms are related to each other and how they are associated with the concept of wellness, on the basis of the review of literature.

According to Centers for Disease Control and Prevention (CDC) Individuals commonly have been considered to be "healthy" if they are not sick. In the United States, health has been measured traditionally in a narrow sense, as morbidity or mortality (Centers for Disease Control and Prevention, 2016). The World Health Organization (1948, p. 100) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." This means that health is more than a recovery from

illness, disease, and debilitating conditions (Sze, 1988). Health is rather considered as a multidimensional construct that includes the physical, mental, social domains by both the individual and the population health purview.

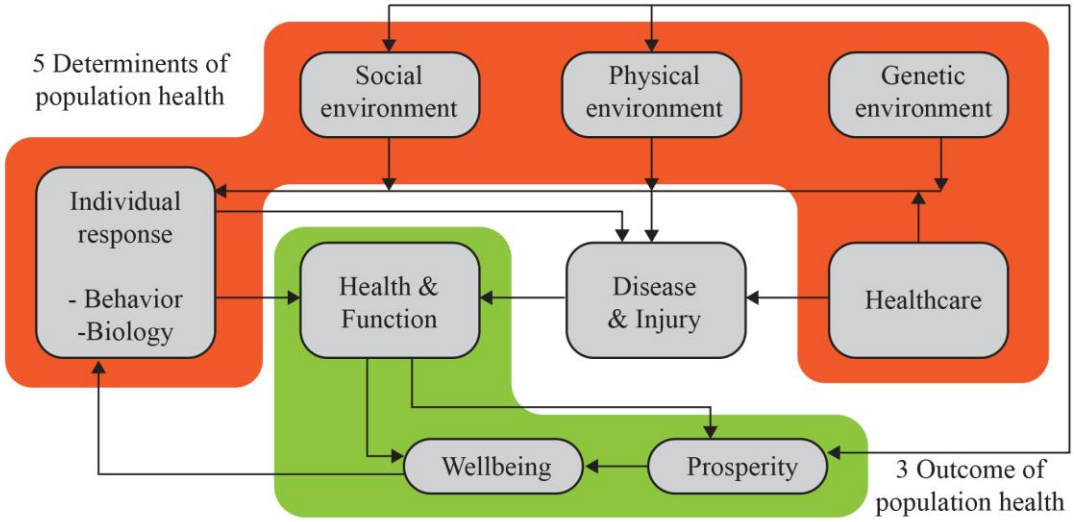


Figure 2.1. *The Evans-Stoddart field model of population health*
(Source: Modified from a paper published in Evans & Stoddart 1990)

Michael O'Donnell (1988), a healthcare consultant, states that optimal health reflects a balance among emotional, physical, spiritual, intellectual, and social health. This concept of optimal health focuses on nutrition, exercise, mental health, and healthful interpersonal relationships (Jenkins, 2016).

Challenges pertaining to optimal health vary for different population groups (American Society of Interior Designers (ASID) academy, n.d.). It is important to know the concept and components of population health if a state of optimal health of individuals is to be achieved. Arah (2009) stated that "individual health" is often regarded as the complement of "population health", because the mean value for a population refers not to "a group of individuals, in contrast to the individuals themselves, depending on the research or policy

purpose" (Kindig, 2007, p.142). According to Stoto (2013, p.2), population health differs from public health, because population health is "less directly tied to governmental health departments" than is public health. In addition, population health connotes the healthcare delivery system as separate from, or in opposition to, governmental public health (Stoto, 2013).

According to Evans & Stoddart's field model of population health (Figure 2.1), five determinants or risk factors of population health can be identified as: Healthcare, Individual response, Social environment, Physical environment, and Genetic environment (Kindig 2007). Health and function, well-being, and prosperity are outcomes of population health.

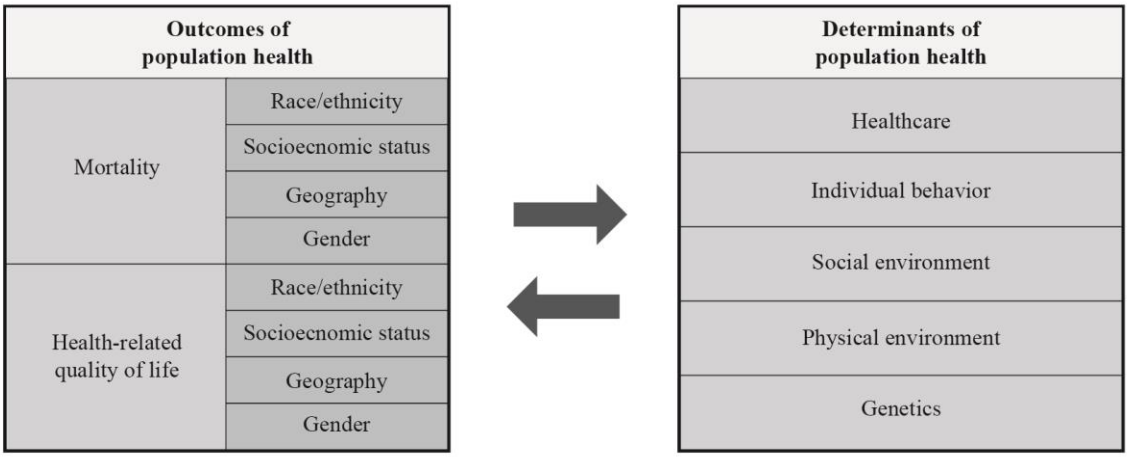


Figure 2.2. *An expanded population health model*
(Source: Modified from a paper published in Kindig, 2007)

Evans & Stoddart used an expanded population health model (Figure 2.2) to present more precise explanations of outcomes into eight categories of population health. Population health outcomes are characterized in terms of mortality rates scores on the Health Related Quality of Life (HRQOL) (Kindg, 2007).

Ferrans (2005) addressed that HRQOL is related to physical, mental, emotional, and social functioning, and is directly associated with well-being of a person's life satisfaction

(Healthy People 2020, 2010). Definition of well-being is related to more than physical health or economic status. It also differs from happiness, a temporary emotion (Healthways, 2014). "Well-being is about the combination of our love for what we do each day, the quality of our relationships, the security of our finances, the vibrancy of our physical health, and the pride we take in what we have contributed to our communities" (Rath et al, 2010, p.4).

In addition, Rath, et al., co-authors of "the five elements of well-being," argue that well-being is broader than just health and wellness, because it incorporates career, social, financial, physical, and community well-being (Figure 2.3) (Gallup-Healthways Well-Being index, 2014; Merberg, 2016; Rath et al, 2010). The concept of well-being thus cannot be confined to one specific meaning.

Categories	Detail
Purpose	Liking what you do each day and being motivated to achieve goals
Social	Having supportive relationships and love in your life
Financial	Managing your economic life to reduce stress and increase security
Community	Liking where you live, feeling safe, and having pride in your community
Physical	Having good health and enough energy to get things done daily

Figure 2.3. *Five elements of wellbeing*
(Source: Modified from a website published in Gallup-Healthways Well-Being index, 2014)

In 1950, Halbert Dunn, M.D., chief of the U.S Office of Vital Statistics, described "a dynamic state-of-being" as "high-level wellness." This is considered to be the first use of the term "Wellness". Dunn stated, "The state of being well is…a fascinating and ever-changing panorama of life itself, inviting exploration of its every dimension" (Merberg, 2016, para.8).

The National Wellness Institute defines wellness as "an active process through which people become aware of, and make choices toward, a more successful existence". The six

dimensions of wellness are occupational, physical, emotional, spiritual, intellectual, and social (Figure 2.4) (Hettler, 1976; National Wellness Institute, n.d., para.2).

Categories	Detail
Occupational	Recognizing personal satisfaction and enrichment in one's life through work
Social	Encouraging contributing to one's environment and community
Emotional	Recognizing awareness and acceptance of one's feelings
Spiritual	Recognizing our search for meaning and purpose in human existence
Intellectual	Recognizing one's creative, stimulating mental activities
Physical	Recognizing the need for regular physical activity

Figure 2.4. *Six Dimensions of Wellness model*
(Source: Modified from a website published by Hettler, 1976)

The Alliance Institute states in their mission statement that "wellness is much more than just a state of physical health. It also encompasses emotional stability, clear thinking, the ability to love, create, embrace change, exercise intuition, and experience a continuing sense of spirituality" (Alliance Institute for Alternative Therapies & Functional Medicine Center, n.d., para 7).

Among these definitions of wellness from Dunn, the National Wellness Institute, and the Alliance Institute, some elements are comparable. First, the goal of wellness is a successful life for the individual. Although it is hard to define the term "successful life", it can be described as satisfying everything that an individual has had or experienced. Second, wellness is an active process, not merely a one-time happy period. It is ceaselessly interacting and establishing relations with the individual in different ways. Finally, Wellness is multidimensional, and is an attribute in common with health and well-being. The dimensions of wellness can be six, seven, or even more than ten in number, depending on who defines the term and how the concept is subdivided into categories.

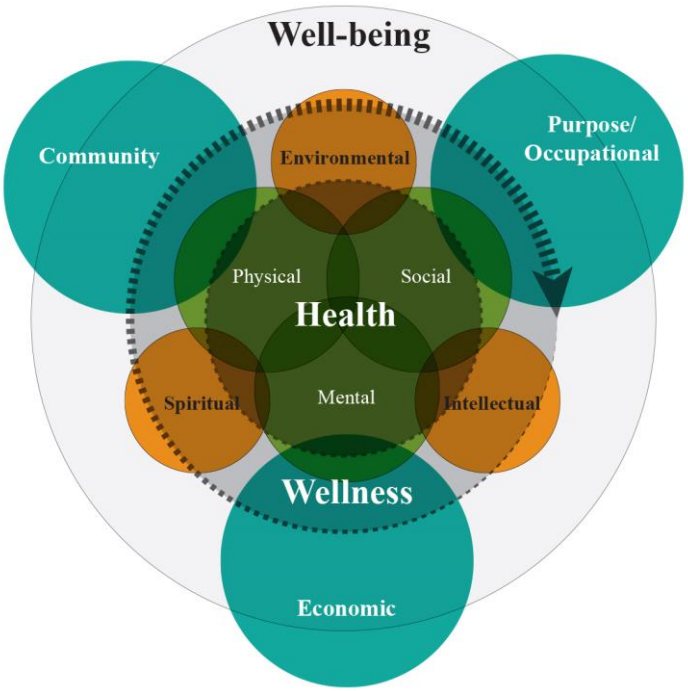


Figure 2.5. *Relationship and range of meaning of health, well-being, and wellness*

There are no distinct differences among the definitions of health, well-being, and wellness, but empirically these three terms are often used to refer to different ranges (Figure 2.5). The term health is used to refer more closely to physical, and mental health and to healthy social relationships. The term well-being, refers to all aspects of quality of life, including financial, occupational, and community aspects. Although the definition of wellness is similar to that of well-being, people often use the term wellness to refer to a similar meaning of health, including spiritual, intellectual, and environmental aspects.

National health goals and trends in the concept of wellness

Every four years, The United States Health and Human Services (HHS) updates its Strategic Plan that addresses complex, multifaceted, and evolving HHS issues (HHS Strategic Plan, 2015). Strategic Plan FY 2014-2018 identifies four main strategic goals (Table 2.1).

Table 2.1. (Source: Modified from a paper published by **HHS Strategic Plan**, 2015)
Strategic goals of HHS Strengthen Plan FY 2014-2018

Goal 1	Strengthen Healthcare
Goal 2	Advance Scientific Knowledge and Innovation
Goal 3	Advance the Health, Safety, and Well-Being of the American People
Goal 4	Ensure Efficiency, Transparency, Accountability, and Effectiveness of HHS Programs

Under Strategic Goal 3: Advance the Health, Safety, and Well-Being of the people, there are six objectives (Table 2.2) related to strengthening communities, to mitigating the impacts of chronic and infectious disease, and to building the capacity to respond and be resilient in the face of emergencies (HHS Strategic Plan, 2015). In particular, Objective D, promote prevention and wellness across the life span, focuses on chronic diseases and related risk factors, including unhealthful diets and physical inactivity, through population and community health activities. HHS also works to support state, local, and tribal public health agencies to promote health through education and self-management and to conduct outreach programs for vulnerable population (HHS Strategic Plan, 2015).

Table 2.2. (Source: Modified from a paper published by **HHS Strategic Plan**, 2015)
Six objectives of strategic goal 3 of HHS Strengthen Plan FY 2014-2018

Objective A	Promote the safety, well-being, resilience, and healthy development of children and youth
Objective B	Promote economic and social well-being for individuals, families, and communities
Objective C	Improve the accessibility and quality of supportive services for people with disabilities and older adults
Objective D	Promote prevention and wellness across the life span
Objective E	Reduce the occurrence of infectious diseases
Objective F	Protect Americans' health and safety during emergencies, and foster resilience to withstand and respond to emergencies

The United States Office of Disease Prevention and Health Promotion has developed a comprehensive set of health promotion and disease prevention objectives, called Healthy People 2020 (HP2020), whose primary intent is to improve the nation's health (Corbin, et al., 2000). HP2020 is designed to create a society in which all people live long, healthy lives. (Healthy People 2020, 2010) There are two major missions defined by HP2020, to identify health improvement priorities, and to increase public awareness and understanding of the determinants of health, disease, and disability and the opportunities for progress (Healthy People 2020, 2010). HP2020 is consistent with improving the HRQOL and it attempts to strike a balance between physical and mental well-being.

Health of Iowans

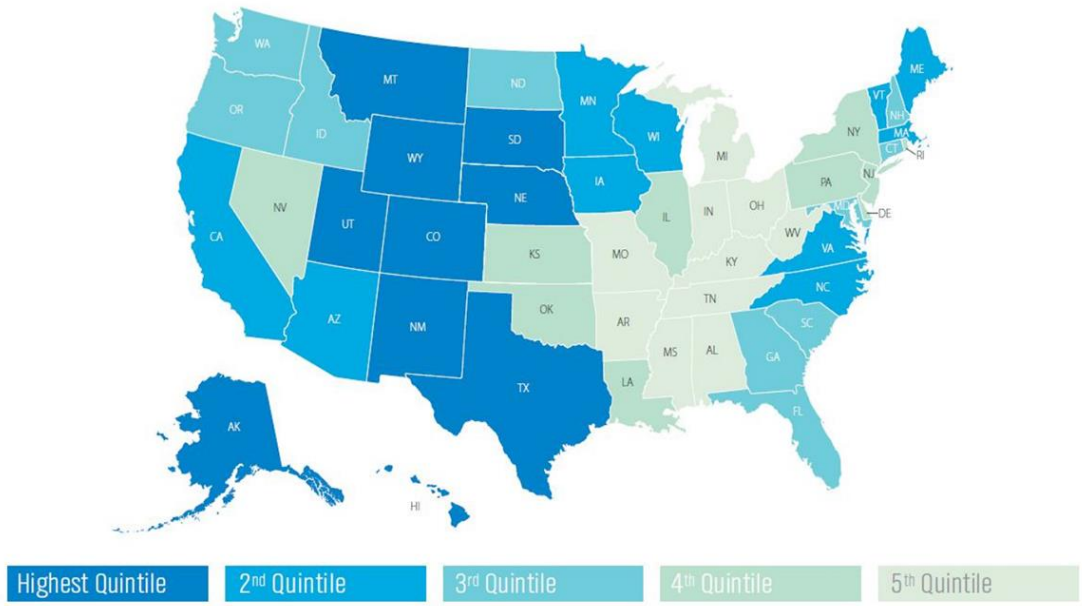


Figure 2.6. *The ranks of well-being index in 2014 (Source: a paper published in Gallup-Healthway)*

In 2014, the state of Iowa was ranked 16th in the Gallup-Healthways Well-Being Index. This rating provides a comprehensive view of Iowa citizens' well-being across five

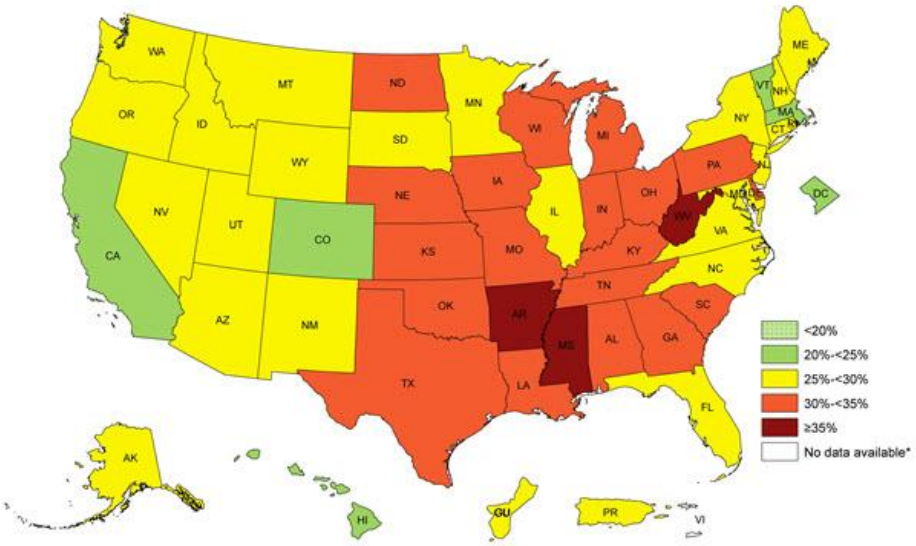


Figure 2.7. *Self-reported obesity among U.S adults by state and territory (source: from a paper published in BRFSS, 2014, CDC)*

elements: purpose-17th, social-40th, financial-9th, community-9th, and physical-36th. Iowa places in the second quintile of states nationwide (Figure 2.6). Iowa's Well-Being Index for 2014 is 66.9. (Gallup-Healthways Well-Being Index, 2014)

According to the Behavioral Risk Factor Surveillance System (BRFSS) prevalence data of 2014, from the CDC, Iowan's obesity rate was 30.9%, ranking it 16 out of the 50 states (Figure 2.7). This rate is similar to the average obesity rate in the United States (34.9%). The Midwest had the second highest prevalence of obesity (30.7%). Obesity is the leading cause of preventable deaths, such as those due to heart disease, stroke, type 2 diabetes, and certain types of cancer (Pi-Sunyer, et al., 1998). According to the CDC data, in Iowa heart disease (23%) is the number 1 cause of death and stroke is number 4 (CDC Official Final Deaths 2014: Released: 1/6/2016). In addition to the obesity rate, we should be aware of physical inactivity rates among adults. As reported by BRFSS 2014, Iowans'

physical inactivity rate was 22.6%, ranking it 26th among all states. This indicates that the inactivity rate of Iowa was similar to the average physical inactivity rates of U.S adults. According to a 2015 Iowa Department of Public Health (IDPH) annual report, "obesity-related health problems cost Iowans $783 million each year" (IDPH annual report and budget summary, 2015, p.87).

To combat these circumstances, IDPH, a non-profit organization of healthcare providers, policymakers, businesses, and many others, works to promote and protect the health of Iowans. IDPH strives to improve the quality of life for all Iowans by assuring access to population-based health services (IDPH annual report and budget summary, 2015). One strategy for Iowans' achieving healthier lives is encouraging physical activities and nutritious diets. The Iowans walking assessment logistics kit (I-WALK), is a program that provides current local information to help update, implement, and evaluate community-based walking groups. In addition, IDPH supports WIC, a special supplemental nutrition program for vulnerable Iowans, such as low-income women, infants, and children (IDPH annual

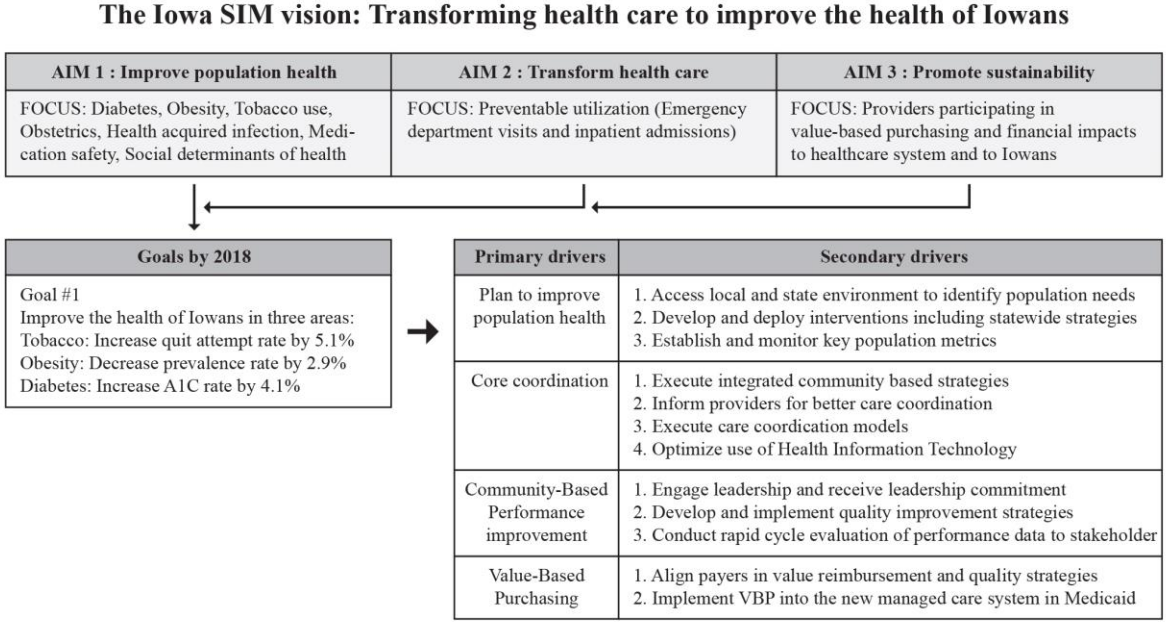


Figure 2.8. *The Iowa SIM vision: Transforming Healthcare to Improve the Health of Iowans (Source: Modified from a paper published in IDHS, 2016)*

report, 2015). These services provide not only healthy food, but help in making informed decisions through nutrition education and consultations with specialists.

Another program for improving population health and patient care as well as modifying healthcare cost trends is Iowa's SIM (State Innovation Model), administered by the Iowa Department of Human Services (IDHS). This program attempts to implement and evaluate a sustainable healthcare delivery and payment system. As is shown in the Iowa SIM vision diagram (Figure 2.8), the program actively attempts to improve the health of Iowans by 2018 in the three areas of tobacco use, obesity, and diabetes. For example, it seeks to decrease the prevalence rate of obesity by 0.9%. This reduced obesity rate would mean that chronic disease rates would be decreased. The Iowan population's health is thus expected to improve as a consequence of the goals being met.

Health and wellness in building environments

Although most of us spend over 90% of our time indoors, we may pay little attention, either inside or outside of our building environments, to the effects of our environmental surroundings on our health and well-being. In the past, design decisions have often been made on the basis of style, cost, and function. Today, however, sustainability, resiliency, and health are at the forefront of design decisions. In 2015, healthcare costs consumed about 18% of the U.S. gross domestic product, representing total healthcare spending of $200 billion a year on avoidable costs (ASID academy, n.d.). Healthier buildings could cut this amount at least by a bit. It is not surprising that more and more business and homeowners are giving attention to the potential benefits provided by healthier environments, including lower

healthcare costs, reduced absenteeism, happier, less-stressed families, and less suffering from allergies and illness (ASID academy, n.d.).

In 2014, ASID and the Clinton Global Initiative (CGI) created a Health and Wellness Protocol (HWP) to help enable the creation of spaces that promote users' health and wellness (Clemons, 2014 September 30). This protocol, a peer-reviewed reliable program for educating designers and architects, is expected to help designers make smarter design decisions related to interior scale, building scale, and exterior scale that place users health and wellness first (ASID, n.d.)

Another example of design considerations in practice is Perkins+Will's wellness strategies. Perkins+Will, one of the most profitable architecture design firms in the healthcare design industry, has announced that wellness is one of the future purposes of their business (Perkins Will Purpose, n.d.; Interior Design magazine, 2016). The firm believes that "design should improve health by redefining the relationship between the built environment, people, and natural environment. In this global model, buildings and communities are transformed into places that promote health and foster wellness" (Perkins Will Purpose, n.d., para 1). Perkins+Will has introduced four strategies to promote their wellness design goals for promoting the company image (Table 2.3) (Perkins Will Purpose, n.d.).

Table 2.3. (Source: Modified from a website published by Perkins Will Purpose, n.d.)

Perkins+Will's wellness goal	
Wellness Goal 1	Researching, creating and using healthy building materials
Wellness Goal 2	Embracing active design tactics in workplace, and developing the concept with government and institutional entities
Wellness Goal 3	Leading innovative solutions for health community design by developing places
Wellness Goal 4	developing health districts to improve health for all people

Health and wellness of employees has become a very common focus in the design of work spaces. The Steelcase research team has introduced six dimensions of well-being (Table 2.4) that might impact the creation of interconnected workplaces offering employees choice and control over where and how they work (Steelcase, 2014 November).

During an interview with Steelcase, Nila Leiserowitz, a regional managing principal at Gensler, said, "For many years, there was a lot of focus on sustainability at work environment, to the point that it became a big issue in talent recruitment. Now we are starting to see that people who are considering an organization want to understand that there's commitment to their well-being" (Steelcase, 2014 November, p.51).

Table 2.4. (Source: Modified from a magazine published in Steelcase, 2014)
Six dimensions of well-being and the design considerations in workplaces

Dimensions of well-being	Design considerations
Optimism: Fostering creativity and innovation	Allow choice and control over where and how people work
	Spaces that allow personalization, instead of enforced workplace standards
	Settings that help employees feel supported in their work
	Design for transparency, so people can see and be seen
	For application ideas, designed to support physical, cognitive and emotional well-being in the workplace
Mindfulness: Fully engaged	Spaces that help people connect with others one-on-one and eye-to-eye, and not just through their technology devices
	Areas that allow workers to control their sensory stimulation and choose if they want to adjust
	Places that are calming, through the materials, colors, lighting and views
	Areas where people can connect with others without distractions
Authenticity: Really yourself	Spaces that help people feel comfortable to express themselves and share ideas.
	Incorporate informal, non-constricting environments with a home-like feel.
	Areas that help people connect their personal values to the brand values
Belonging: Connecting to others	Entrances that are welcoming with visible hosting for people who don't work there routinely
	Well-equipped spaces for mobile and resident workers to work individually or in teams
	Videoconferencing configurations that allow remote participants to see content in the room and on the walls, and to hear everyone equally.
	Informal areas for socialization, in person as well as virtually
Meaning: A Sense of purpose	Spaces beyond the lobby that reinforce the brand, purpose, history and culture
	Leverage vertical real estate to make thinking and progress visible
	Technology to display real-time information
	Eco-system of spaces that give people choices and empower them to work productively alone or together
Vitality: Get-up-and-go	Areas that give people choices for controlling the level of sensory stimulation
	Easily adjustable furniture to fit a range of sizes, needs, and preferences and to promote movement throughout the day
	Cafés with healthy food choices and displays
	Nature in with daylight, views, ventilation, patios, etc.
	Support active, healthy lifestyles with centrally located stairways, outdoor walking paths, bicycle racks, etc.

Theories and areas of study relevant to the wellness concept

This section identifies four design theories and areas of study that are closely related to the health and wellness concept. These theories are considered to form the background principle of Evidence Based Design (EBD). The Center for Health Design (CHD) defines EBD as the process of basing decisions about the built environment on credible research to achieve the best possible outcomes (CHD, 2009). CHD emphasis the earliest process of EBD is finding reliable sources of relevant evidence.

Relevant literature regarding the wellness concept in healthcare design will now be discussed. As already stated, the wellness concept in healthcare facility design is related to the physical, emotional, and social responses to a built environment. Emphasis will be on the following topics: Psychoneuroimmunology (PNI) and stress, healing environments, supportive design, and active design theory.

Psychoneuroimmunology and stress

Psychoneuroimmunology (PNI) is the study of the interaction between psychological processes and the nervous and immune systems of the human body (Irwin, 2005). The main idea of PNI is that the mind and body functions are connected to each other to form a single unit (Shepley, et al., 1998). In relation to the built environment, it is an aspect of "the art and science of creating environments that prevent illness, speed healing, and promote well-being" (Purves, 2009, p.76).

Beatriz Arantes, a psychologist and senior researcher based in Paris for Steelcase, stated during an interview with Steelcase that "Western culture typically views the mind, the

body, and the environment separately, but science is showing that they are intricately linked, as Eastern cultures have long known" (Steelcase, 2014 November, p 34).

Despite the emergence of growing evidence, there is as yet no clear demonstration of a relationship between PNI and the physical environment (Solomon, 1996). Solomon suggests reducing stress by providing the patient with control of pain medication, lighting, music, and television programing. Ulrich claims that stress is a major obstacle to healing (Ulrich, 1991). Antonovsky (1979, p.72) also describes stress as the "demand made by the internal or external environment of an organism that upset its homeostasis." Regarding patient stress, Ulrich states that "it is linked with psychological, physiological, and behavioral dimensions of wellness" (Ulrich, 1991, p.99). Ulrich also talks about stress as a problem for families of patients, visitors, and staff. Recent research suggests that severe stress experienced by caregivers has suppressive effects on their immune system functioning (Kiecolt-Glaser, et al., 1987). If staff members in a healthcare facility experience considerable stress, this can result in lower quality of healthcare facility experiences for the patients and visitors.

Healing environment

Healing involves more than curing. Curing stops at the stage of physical wellness of a patient, while healing includes the individual's spiritual and psychological well-being as well (Gappel, 1990). A healing environment is an environment that exploits science and medical technology while supporting the physical, mental, and spiritual needs of patients, families, and caregivers to enhance therapeutic outcomes (Shepley, et al., 1998). Numerous evidence-based studies have shown that healthcare facility's physical environment may have an impact

on health by influencing the behaviors, actions, and interactions of patients and their families as well as staff members who provide the care (Schweitzer et al, 2004).

The role played by the physical setting in the healing process, and more importantly in improving patient outcomes and the well-being of families and caregivers, has been stressed (Moore, 2000; Visentin, 2006). Joseph (2006) concurred regarding the influence of the physical environment on the healing process and elaborated further that the physical environment also contributed towards a better quality of life not only for the patients, caregivers, and staff, but also for visitors.

OPTIMAL HEALING ENVIRONMENTS

Developing Healing Intention	Experiencing Personal Wholeness	Cultivating Healing Relationships	Practicing Healthy Lifestyles	Applying Collaborative Medicine	Creating Healing Organizations	Building Healing Spaces
						
Expectation Hope Understanding Belief	Mind Body Spirit Energy	Compassion Empathy Social Support Communication	Diet Exercise Relaxation Balance	Conventional Complementary Traditional Integrative	Leadership Mission Culture Teamwork Technology Evaluation Service	Nature Color Light Artwork Architecture Aroma Music
Enhance Awareness	**Enhance Integration**	**Enhance Caring**	**Enhance Awareness**	**Enhance Medical Care**	**Enhance Process & Structure**	**Enhance Sensory Input**
Inner environment					Outer environment	

Figure 2.9. *The optimal healing environment Framework by Samueli Institute, exploring the science of healing (Source: Modified from a paper published by Sita Ananth (2008), Healing Environments: the next natural step, Explore, Vol. 4, No. 4, p. 274)*

In 2002 Wayne Jonas, MD, president and Chief Executive Officer of the Samueli Institute, a nonprofit medical research organization investigating healing processes, developed the concept of the Optimal Healing Environment (OHE), defined as "one where the social, psychological, physical, spiritual, and behavioral components of healthcare support and stimulate the body's innate capacity to heal itself" (Ananth, 2008, p.273). As shown in Figure 2.9, the wholeness approach toward the healing process comprises both the inner and outer environment. The inner environment involves developing a healing intention,

experiencing personal wholeness, and cultivating healing relationships, while the outer environment involves practicing healthful lifestyles, applying for collaborative medicine, creating healing environments, and building healing spaces.

Ananth's (2008) idea of the OHE is of interest to the present study because it is related to the building of healing spaces or physical environments that lead to enhanced sensory input. Those areas involved are architecture (which naturally includes ergonomics and safety considerations, color, artwork, and lighting), aroma, music, nature elements, and outdoor gardens. Venolia (1990) notes that nine internal and external qualities contribute to a successful healing environment: 1) positive self-awareness, 2) a link to nature, culture, and people, 3) a sense of privacy, 4) safety of the harmless environment, 5) meaningful and diverse stimuli, 6) a place for relaxation, 7) interaction with the outside, 8) a balance between the novel and the familiar, and 9) beauty.

Schweitzer, et al., (2004) on the basis of existing research findings, summarized physical parameters that create impact as healing space: personal space, environmental complexity, fresh air and ventilation, light (both natural and artificial), color, views of nature, experiences of nature, art, esthetics, and positive distractions (humor and entertainment).

Supportive design theory

Although the quality of hospital care and medical care in general are still the major components that impact patient health outcomes and wellness, many researchers contend that the built environment is also an influential factor that supports or facilitates reduction of stress related to illness and hospitalization (Ulrich, 1991, 2001). Ulrich (1991) developed a supportive design theory that explains essential aspects of healthcare facility design that help

to create an optimum healing environment (Escobar, 2014). Supportive design theory starts with eliminating stressful environmental elements that have a negative impact on a user's wellness, and then focuses on research related to areas that can calm patients, reduce stress, and strengthen coping resources and the healing process (Ulrich, 2001). Supportive design theory emphasizes the achievement of three goals: fostering a perception of control, including privacy, promoting social support, and providing access to nature and other positive distractions such as those involving sensory aspects. The theory also suggests that a healthcare facility's users include not only patients but also visitors and staff in (Ulrich, 1991).

Active design in building the environment

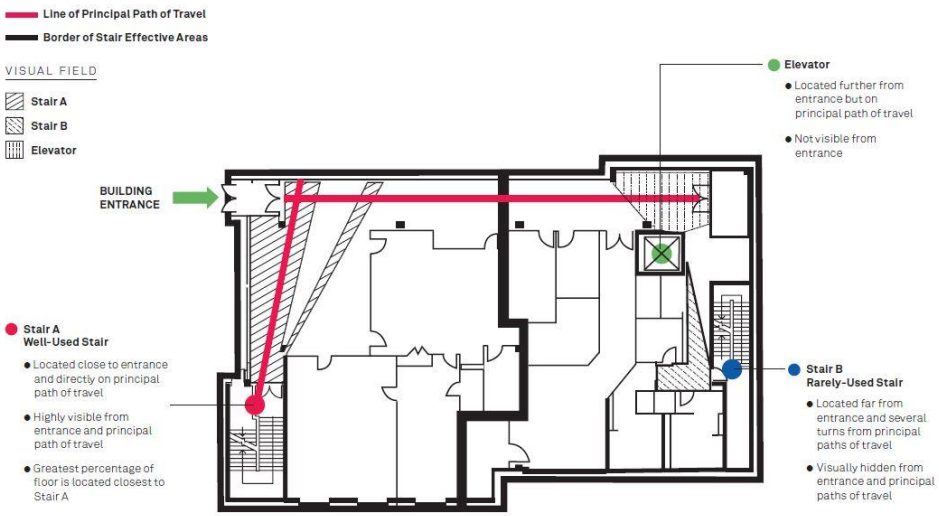


Figure 2.10. *High visibility of staircase bring more user to use stair*
(Source: From a book published by Active design guideline)

In 2010, the City of New York and the Center for Active Design published a set of population health-related guidelines entitled 'Active Design Guidelines: Promoting Physical Activity and Health in Design'. These guidelines aim to provide architects and urban designers in New York City and beyond with a manual for creating healthier buildings,

streets, and urban spaces (Active Design Guidelines, 2010). Active design is an environmental design that encourages stair climbing, walking, bicycling, transit use, physically active recreation, and healthy eating, based on current academic research as well as best practices and cost-effective solutions (Active Design Guidelines, 2010). Opportunities for incorporating regular physical activity into daily life can happen inside buildings, and designers can help building occupants incorporate physical activity into their daily routines through strategies such as the following (Table 2.5):

Table 2.5. (Source: Modified from a book published in Activity design guidelines)

Activity design's four strategies	
Strategy 1	Increase stair use by providing a conveniently located stair for everyday use, posting motivational signage to encourage stair use, and designing visible, appealing and comfortable stairs.
Strategy 2	Locate building functions to encourage walking to shared spaces such as mail box and dining rooms, provide appealing, supportive walking routes within buildings.
Strategy 3	Provide facilities that support exercise such as centrally visible physical activity spaces, showers, locker rooms, secure bicycle storage, and drinking fountains.
Strategy 4	Building design that contributes to a pedestrian friendly urban environment and that include maximum variety and transparency, multiple entries, stoops, and canopies.

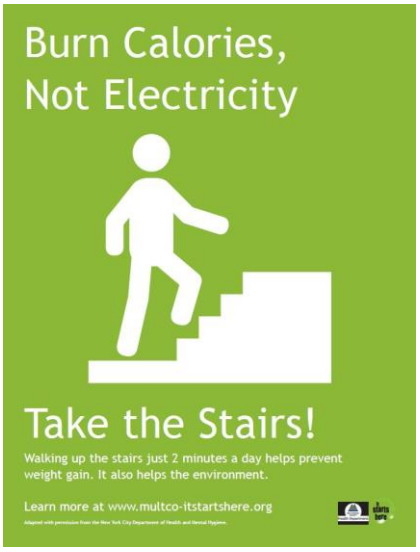


Figure 2.11. *Poster and signage that encourage using more stairs than elevators (Source: From a book published by Active Design Guideline)*

Active design stresses benefits not only for the health of the public but also for the areas of both environmentally-friendly design and universal design. Active design strategies that increase physical activity and improve health also tend to reduce energy consumption and greenhouse gas emissions. Active design can benefit not only people who are able to climb stairs daily, but users at all levels of mobility, age, and background. A diverse, active, healthy population and a sustainable planet are synergistic.

Design Issues that Affect User's Wellness in a Healthcare Environment

Being a patient in a hospital or a doctor's office can be a stressful experience (Wilson-Barnett, 1979). From admission to arrival in a patient room, patients are confronted with an unfamiliar environment, lose much of their independence and sense of control, and are separated from their friends and family (Carpman & Grant, 1993).

Professionals are beginning to recognize that well-planned design can improve the quality of shortening stays in health facilities and recovery room (Lemprecht, 1996). Environmental quality is important for reasons beyond the image presented of the healthcare facility. The wellness aspects of design also should be considered. The design of the facility, its color, plan, arrangement of furniture, availability of outside views, and accommodation of visitors are all part of patients' movement toward recovery (Canter & Canter, 1979; Carpman & Grant, 1993; Mathews, 1976; Petrie, 1980; Remen, 1982).

In this section, five design issues will be briefly discussed: 1) user experiences, 2) positive distractions, 3) sense of control, 4) social support, and 5) safety and security. All affect users' wellness in a healthcare facility.

User experience

Designing a user experience, the total experience obtained from a healthcare facility, is an essential consideration while planning a healthcare facility. In choosing a facility for managing their health, the public considers a variety of factors that taken together help define the term "high-quality care" (Falick, 1981). Designing with user experience in mind recognizes that people's images of healthcare facilities are multidimensional, and that having

a technologically-advanced facility may not be enough to satisfy users. What users see, hear, and smell blends into one impression. A physical environment that supports the psychological needs of users will be regard as a positive, caring environment (Carpman & Grant., 1993).

In the United States all hospitals are required to conduct the patient satisfaction and user experience survey that the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) has developed under direction of the federal government's Centers for Medicare and Medicaid Services for adult inpatients except psychiatric patients. The results of the survey reveal that the overall rating of the all hospitals in the U.S is 72 on a scale of 100 (HCAHPS, n.d.), indicating that there is a room for improvement in U. S. hospitals.

Healthcare environmental research has focused mainly on the effects of the hospital environment on user experience while engaging in healthcare activity (Arneill & Devlin, 2002; Olsen & Pershing, 1981; Ulrich, 1984). An important part of this experience is related to the quality of patient care. Although it is difficult to precisely define the concept of quality of care (Rempusheski, et al., 1988; Wilde, et al., 1993), it is heavily influenced by the amount of empathy, warmth, and friendliness experienced by a user (Arneill & Devlin, 2002). They stress that healthcare environment plays an important role in conveying empathy, warmth, and friendliness even prior to the first interaction between a patient and the staff of a health-care facility.

Positive distractions

Positive distractions are major design components that create positive user experiences in a healthcare facility, and researchers have found that such distractions can

effectively reduce stress and promote wellness for patients, family members, and staff (Ulrich, et al., 2007). A positive distraction is defined as "an environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking worrisome thoughts" (Pati & Nanda, 2011, p.125). Distractions in healthcare environmental design can be divided into two main categories. One is nature, i.e., providing elements of living things as in indoor and outdoor gardens. The other features are provided in the built environment. Both types of positive distractions have sensory components.

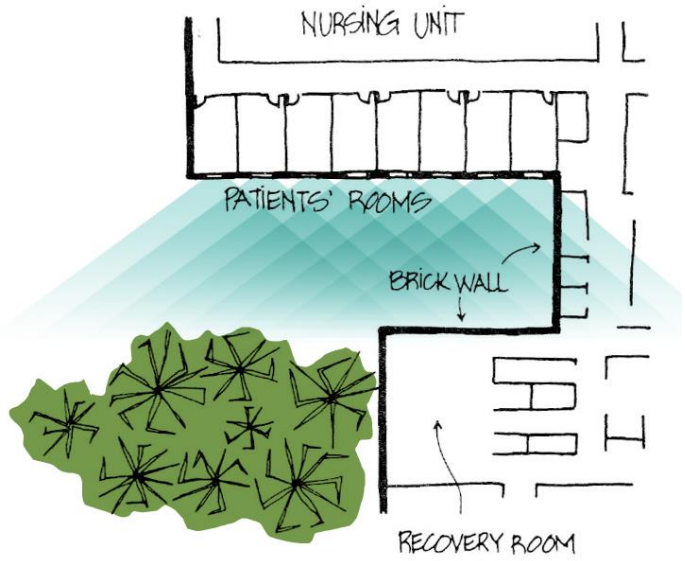


Figure 2.12. *Floor plan for Ulrich study*
(Source: Modified from a paper published by Ulrich, 1984)

Ulrich points out that access to positive distractions is paramount to a supportive theory of design, and that nature is one of the most effective positive distractions (Ulrich, 1991). According to Ulrich's research (1991), accessing nature is a multi-sensory experience. It stimulates all the senses, i.e., sight, smell, sound, and touch in varying degrees. Since both direct access to nature and passive views of nature can reduce stress, and availability of windows provides an alternative to direct access to nature (Shepley, 2004), providing windows can have a significant impact on a patient's physiological and psychological condition (McKahan, 1993). For example, as shown in Figure 2.12, patients with views of a small park with trees and flowers experience better nurse evaluations, less need for medication, and shorter hospital stays than patients with only

a view of an adjacent brick wall (Ulrich, 1984). “How patients and visitors experience an environment is affected by noise levels, temperature, odors, and lighting, as well as by how capable and successful they are in manipulating their environment or comfortably positioning themselves within it” (Carpman & Grant., 1993, p.9). There is a growing body of research on therapeutic environments. Table 2.6 describes elements of positive distractions and their implications.

Table 2.6. (Source: Modified from a website published by Smith & Watkins, 2008)
Design elements of positive distractions

Category	Detail
Views of nature	From patient rooms, and wherever possible in lobby, waiting, and other 'high stress' areas
Access to nature	Healing gardens
Peaceful place	Chapel, meditation room, and meditation gardens
Artwork	Depicting nature, including back-lighted photographs of nature
Music	Live piano in public area, recorded music in patient room when programmed specifically to create a healing environment
Pets and other activities	Allowing for a sense of stimulation that help nurture a patient's sense of positive well-being
Mild physical exercise	corridors, public spaces, and gardens that invite walking when appropriate

Sense of control

Bilchik, in her book A Better Place to Heal, wrote “When you know that you have an option, even in the most minimal sense, you feel better” (Bilchik, 2002, p.10).

Steptoe & Appels (1989) claim that sense of control is an important factor influencing stress levels and wellness for groups of people in various situations. Ulrich (1991) also indicated that lack of control might result in depression, passivity, elevated blood pressure, and immune system suppression. Studies have demonstrated that the negative effects of environmental stressors can be reduced when people have a sense of control over things happening to them (Evans, 1984).

Figure 2.13. *Luminous ceiling from Philips simulates daylight to comfort (Source: Modified from a paper published by LEDinside, 2013)*

Healthcare facility users should be encouraged to be as independent as possible, and the design of a healthcare unit should support this intention by allowing patients to control room lighting (Figure 2.13), temperature, the amount of privacy they have, wayfinding issues, and the involvement of the patient's family as caregiving partners (Table 2.7) (Malkin, 1991).

Table 2.7. (Source: Modified from a paper published in Smith and Watkins, 2008)
Design elements of personal control and choice

Category	Detail
Privacy	Private patient rooms result in better outcomes
User control	Give the patient control over the immediate environment. i.e., radio, TV, reading light, night light
	Volume and programming control of televisions in waiting areas
	Choice of lighting and artworks, patients and staff can benefit from personal dimming controls.
	Room service/menu selection
Wayfinding	The built environment should provide clear visual cues to orient patients and families, and guide them to their destination and return. Landscaping, building elements, daylight, color, texture, and pattern should all give cues, as well as artwork and signage
Information	Provide mini-medical library and computer terminals so patients can research their conditions and treatments
Amenities	Storage area for patient belongings

A major issue in healthcare design related to sense of control is wayfinding in a building. Difficulty in finding one's way around a healthcare physical environment often will affect one's stress level and physical activities. In particularly, large and complex buildings such as hospitals often feel like mazes for users who only occasionally visit such places. Signage and graphics may help, but they need to be used in conjunction with spatial design features as part of a coordinated wayfinding system (Carpman & Grant, 1993).

Social support

Much research in behavioral sciences has shown that, in a wide variety of health and non-health situations, a group of people with high social support, compared to one with low social support, experiences less stress and achieves higher levels of wellness (Cohen & Syme, 1985; Sarason, 2013; Ulrich, 1991).

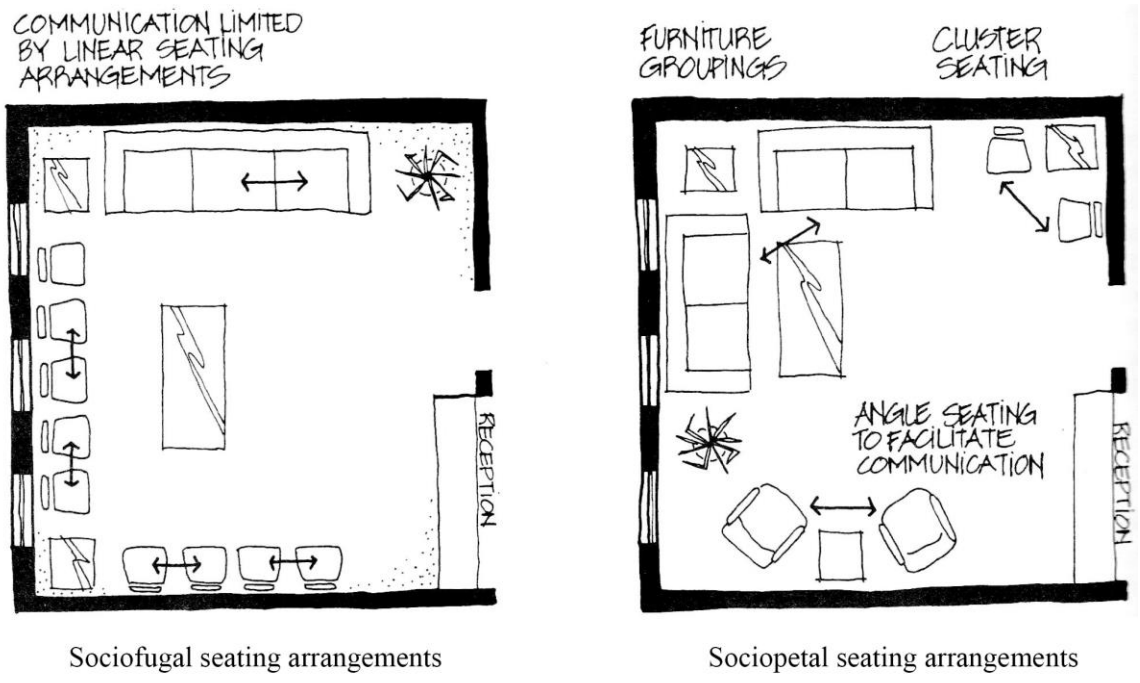


Figure 2.14. *Clustered seating arrangements may encourage social interaction while a linear seating organization will limit communication*
(Source: Modified from a book published in Shepley)

Shepley (2004) points out that privacy, social interaction, and personal space are three environmental/behavior factors highly related to social support in healthcare settings. First, a person's ability to control privacy and social interaction contributes profoundly to a sense of well-being (Zimring, 1981). Privacy may be called solitude, but it may also may mean a place that permits intimacy and in which two or more people can engage in personal conversation and share special feelings, secure from outside intrusions (Holahan, 1982). For example, Holahan has found that sociopetal seating arrangements (Figure. 2.14) may provide more opportunities for communication than sociofugal seating arrangements.

A family-centered care center often can bring a number of people together in a healthcare facility, possibly fostering a sense of over-crowdedness in the hospital setting. Overcrowded environmental settings tend to restrict people's behavioral freedom, so private spaces in a hospital can become crucial in facilitating intimacy among both family members and staff members. A family-centered care philosophy is one approach that advocates a successful way to improve the quality of life for patients and their families (Shepley, 2004).

Personal space is another environmental factor linked with people's behavior in any setting shared by several individuals, and organization and layout of environments can influence people's perception of crowding and density. The negative consequences of high density can be reduced when people are able to experience personal control over it (Moos & Schaefer, 1984). By allowing people to interact with others while at the same time preserving intimacy, a spatial configuration can be arranged to communicate a sense of personal control (Shepley, 2004).

Table 2.8. (Source: Modified from a paper published in Smith & Watkins, 2008)
Design elements for social support

Category	Detail
Family centered care	Family zone in patient room, with furniture for sleeping, phone and Internet connection, reading light with separate control, and out of the way of staff
	Organize Family Focus Groups and Patient and Family Advisory Councils to be an active part of the design process, tuning in to the specific needs of the population and community to be served, as recommended by the Institute for Family-Centered Care
	Provide accommodation for accompanying family member to be with patient throughout the examination and treatment process
	Provide places where patients can engage socially with family and other caregivers.
Culture	Ensure culturally appropriate environments
Furniture layout	Societal spaces facilitate social behaviors and the development of social groups (movable seating, round tables, etc.)

Shepley describes social interaction as another important aspect of behavior related to spatial organization and privacy. Communal kitchens, common dining rooms, lobby areas, and children's play areas are commonly considered to be social interaction spaces that allow family members and visitors to interact in a casual manner and establish a sense of community.

Safety and security

Safety and security are important issues in a healthcare environment where various kinds of treatment take place and large numbers of people are involved (Hartnup, 1993). Family-centered care in particular increases the number of individuals present in an environment and thus may increase the need for security measures (Horowitz, 1993).

Carpman & Grant (1993) emphasize that one important goal of healthcare facility design is to help prevent illness and injury. For example, with regard to patient falls and fall-related injuries in healthcare facilities, any patient can be at risk for a fall due to a change in medical condition, surgery, medical procedures, or testing that might leave them weakened or confused. In the U.S, thousands of patients fall every year, with 30 ~ 50% of falls resulting

in injury. This has added an average of 6.3 days to hospital stays, at an average cost for a fall with injury being about $14,000 (Joint Commission, 2015).

Another example of a safety and security issue is healthcare-associated infections (HAIs). In one study, the estimated number of HAIs was about 1.7 million, and the estimated number of deaths associated with HAIs in 2002 was 98,987 (Klevens et al., 2007). According to an HAI progress report (2014 date, CDC), HAIs were drastically reduced for the years 2008 through 2014 as a result of special attention to HVAC design, materials, and space planning (Zeit, 2014). Design decisions truly can be effective with respect to safety and security issues in healthcare environments.

Quality of User's Experience in Healthcare Main Lobby

In the previous section, five design issues related to healthcare-oriented design of both public and clinical spaces were summarized. This section will examine design considerations for improving the quality of a user's wellness design experience in the main entry lobby of a healthcare facility. The researcher has reviewed the literature and identified five wellness design criteria that improve quality of user's experience: improvement of user's experience, optimal positive distraction, enhancing user's sense of control, aspects of social support, and safety and security enhancement.

Both user-experience based wellness design criteria and these design elements of a healthcare facility's main entry lobby can affect a user's physical well-being, emotional health, and social interaction.

Improvement of user's experience

Entrance experience

The main entrance established the first impression of a healthcare facility (Olsen & Pershing, 1981), and such a first impression can set expectations for the quality of care in the facility as well as providing a transitional zone from the exterior to the interior space. According to Anita Olds (1985, p.105), "the entrance should have signals that express the transition from that which is spontaneous and ordinary to that which is spiritually and aesthetically integrated."

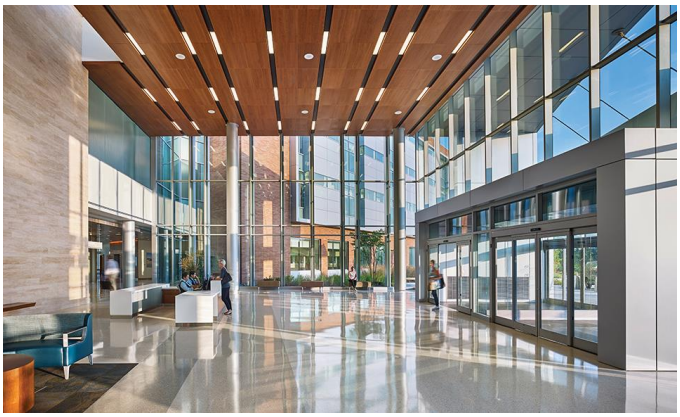


Figure 2.15. *The main entrance at UNC Hospital Hillsborough Campus (Source: From a website published in Contract magazine, Copyright 2015, Halkin, Mason photography, Design by ZGF Architects, BJAX/EYP)*

Designers should also consider accommodations that may be necessary for special users. For example, it is important to make the doorway wide enough for a person in a wheelchair or pushing a baby stroller to pass through. Providing doors that open easily or automatic doors with pressure-sensitive buttons allows people to enter easily. Providing a space for storing wheelchairs to avoid creating obstructions at the entranceway is also beneficial in managing the flow of traffic. A vestibule or wind lock is important for people sitting near the entrance who might otherwise feel a draft in winter (Carpman & Grant, 1993; English Tourist Board, 1983; Harkness & Groom, 1976; Malkin, 1991)

Figure 2.15 shows an example of a well-designed main entrance of a hospital that provides space for people to wait for transportation, to communicate with others, and to become oriented to the overall layout of the healthcare facility (Carpman & Grant, 1993). At

the entrance, users should have a clear view of the information desk and admitting department because they often need immediate services from those departments (Malkin, 1991).

Check-in experience

The admitting department is often the second destination (after the entrance area) for patients coming to a healthcare facility (Carpman & Grant, 1993). Typically, patients or their companions are required to wait for a turn, to fill out forms, to be interviewed by staff, and perhaps to visit one or more secondary services before going to the appropriate department for their procedures. Being admitted to a facility can be a stressful experience (Carpman & Grant, 1993). During the process, patients and companions should have a comfortable place to wait and a private location for carrying on confidential conversations with staff. Recently, many healthcare facilities have provided self-check-in kiosks for increasing the efficiency of the check-in process (Figure 2.16).

Figure 2.16. *Check-in Kiosks at Ravenswood Family Health Center (Source: From a website published in Healthcare design magazine, Copyright 2016, Donald Satterlee, Design by INDE Architecture)*

Waiting experience

The healthcare waiting area may be both the first and the last area a user sees and experiences. However, it sometimes is one of the last areas to which hospital administrators

direct their attention (Morgan, 2015; Steelcase, n.d.). Regardless of their medical conditions, patients and visitors are likely to spend at least some time waiting at a healthcare facility. Waiting may take place in many different spaces throughout the facility, e.g., in a clinic main lobby, in dedicated waiting rooms, in patient rooms, and in hallways (Carpman & Grant, 1993), and the waiting experiences may differ according to the type of space. For example, in the main entry lobby of a inpatient hospital, patients and visitors need a safe, comfortable place to wait be picked up by a family member or some other means of transportation. In the case of ambulatory care centers, patients and visitors may share waiting and reception areas with others, depending on the size of the facility.

In general, the main entry lobby area is often designated as an official waiting area and located where users can see outside and view the traffic in front of the facility (Carpman & Grant, 1993). While patients and visitors waiting in the entry lobby can sometimes get frustrated by the length of the time they must wait and by the tedious nature of environment, good design can help lessen some of these negative aspects of the experience.

Providing accessible amenities such as restrooms, drinking fountains, free wireless connections, books, and/or information related to health management can make users feel more comfortable and free from stressful events while they wait. And opportunity whether to interact with others or keep to themselves also important considerations for comforting them in their waiting experience (Carpman & Grant, 1993).

Wayfinding experience

The journey from home to the healthcare facility entrance can vary from person to person. Someone who has visited the facility before is less likely to become lost than someone visiting the facility for the first time. Visitors may come from home or from out of town. There is no typical experience shared by all people (Carpman & Grant, 1993). Wayfinding issues may also occur at multiple stages of the visit, such as in going from the city level to the local street level, from the entrance drive to the parking structure or drop-off area, or from the building entrance to a specific department.

Although many facility users may have little or no trouble finding their way from the main lobby, people who unfamiliar with a facility may easily lose their way (Carpman, et al., 1984; Reizenstein, 1981; Shumaker & Reizenstein, 1982) and getting lost in a healthcare facility can be a major stress factor. Carpman & Grant (1993) contend that a wayfinding system (Figure 2.15), including elements such as a clearly identified entrance area, signs, adequate illumination, and you-are-here maps can assist users in finding their way after they arrive at their parking spots or drop-off areas (Carpman & Grant, 1993).

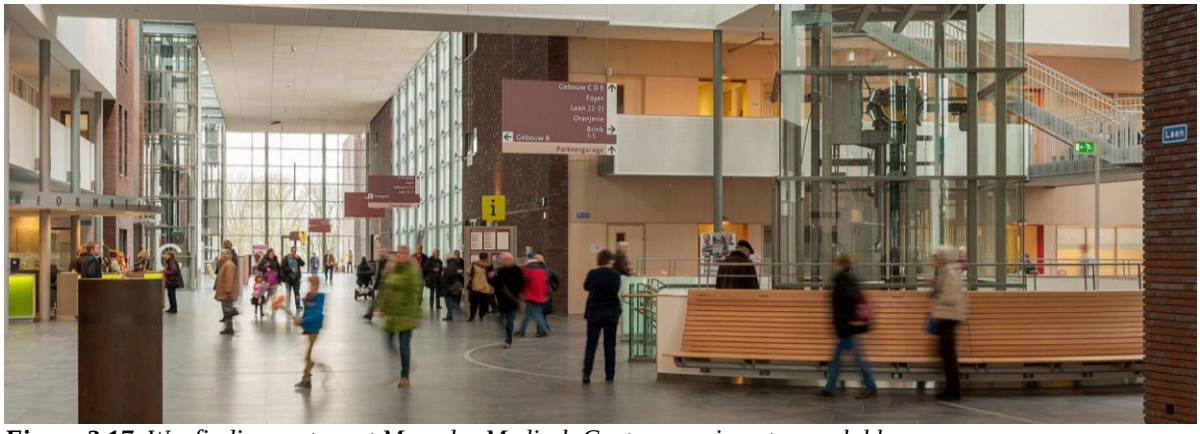


Figure 2.17. *Wayfinding system at Meander Medisch Centrum main entrance lobby*
(Source: Modified from a website published in Mijksenaar, Design by Atelier PRO)

When users enter the facility, they want to know where they should go depending on the purpose of their visit. A well-designed spatial configuration, set of signs, maps, and kiosks, in conjunction with an information desk (Figure 2.17) located near the entrance, can help orient them to the facility without additional staff assistance (Carpman & Grant, 1993).

Providing an information desk is closely related to helping solve wayfinding problems (Olsen & Pershing, 1981). According to Olsen & Pershing (1981) 74% of users stopped at an information desk immediately after entering the facility, and although not all of them obtained proper directions at the information desk, Olsen & Pershing claim that its immediate visibility is crucial.

It is also important to provide alternate wayfinding systems for physically challenged persons. For example, hearing-impaired individuals should be able to follow directions without spoken cues, and warning signals should provide both visual and auditory cues for both hearing-impaired and visually-impaired individuals (Carpman & Grant, 1993).

Amenities

Users in the main lobby may engage in multiple activities. People do not necessarily stay in the main lobby to rest. Users may need to use a restroom, to look for their children, to find places to put their personal belongings, to look at clocks for checking the time, to contact someone via the Internet or by telephone, to learn more about their illness and how to achieve a healthier life, to read material such as newspapers, and magazines, or want food or snacks. The availability of amenities for satisfying these requirements helps reduce the stress of the waiting experience (Carpman & Grant, 1993).

Optimal positive distraction

Natural element

The attractiveness of a waiting space may have a positive impact on a user's waiting experience by reducing the perception of waiting time, decreasing the level of anxiety, improving the quality of interpersonal interaction, and promoting user satisfaction (Pati, 2010). One well-known element of healthcare design that can contribute to the attractiveness of the waiting environment is nature. Sheila Semrou, a member of the American Academy of Healthcare Interior Designers (AAHID), ASID, and a principal of Sheila Semrou Consulting LLC, states, "By taking design cues from local scenery, geographic elements, and panoramic vistas, designers can deliver projects that will feel more comfortable, function better, and work with mind, body and spirit to promote well-being" (Semrou, 2015, pp. 2).

Figure 2.18. *The main entry lobby at Marlborough Hospital Cancer Pavilion (Source: Modified from a website published in Healthcare design, Copyright 2014, John Giammatteo, Design by S/L/A/M Collaborative)*

Providing visual and physical connections to nature,by offering outside views (Figure 2.18), water features, well-controlled natural light, natural color, easy access to the outside, nature-themed artwork, and indoor and outdoor healing gardens, can decrease stress in patients, visitors, and staff using the main entry lobby (McCullough, 2009). For example, an appropriately designed water feature can offer positive aspects such as visual and auditory

stimuli as well as serving as a wayfinding element (Joseph, 2006). Other classic examples of nature elements in the healthcare facility main lobby are healing gardens and nature-themed artwork. Marcus & Barnes (1995), in a study of gardens, found that 75% of users visited the garden once a day. 94% of them went there to relax, and 75% used the garden as a place for eating and talking. Among those who visited the garden, 95% reported positive mood changes ranging from achieving a spiritual connection to reduced stress. People also prefer to see natural scenes, including window views and artworks sufficiently complex to be interesting, but clear enough that people do not feel threatened (Shepley, 2004).

Sensory aspects

Most nature elements are closely associated with sensory aspects. Ulrich (2001) points out that the stress-reducing or restorative benefits of experiencing nature manifest themselves as a constellation of positive emotional, psychological, and physiological changes related to sensory experiences. Positive distractions can help alleviate stress, so proper lighting, colors, finishes, artwork, and accessories that can all contribute to creating a warm, intimate, non-institutional atmosphere are important. Sensory aspects in the healthcare main lobby should focus on the five senses, sight, smell, taste, hearing, and touch. Art, light, color (Figure 2.19), aroma, white noise, and air quality and temperature play significant roles in creating and developing positive sensory experiences in this space.

Figure 2.19. *The main entry lobby at Pediatric Center at Omaha Children's Hospital and Medical Center (Source: From a website published in Flicker, Copyright 2010, Malone & Co, Design by HDR architecture, Inc.)*

Florence Nightingale in her book expressed the thought that "beautiful objects" such as artwork, light, and color are valuable aids to the recovery process. Neumann stresses that such environmental elements affect "being" and the healing process (Neumann, 1995). Hathorn & Nanda (2008) and suggests that geographically familiar artworks are applicable, while use of abstract art may be inappropriate (Hathorn & Nanda, 2008; McCullough, 2009). Such elements can reduce heart rates, blood pressures, and anxiety levels (Coss, 1990; Shepley, 2004).

Many studies have examined the impact of noise and potential stress to people in healthcare settings (Shepley, 2004). Highlighting peaceful sounds such as birdsong and rippling water can enhance the therapeutic environment. In particular, the sound of water can serve as white noise to counteract unwanted sounds, and sound-absorbing materials can improve user experiences by protecting users from noise (Escobar, 2014; Shepley, 2004). Smith (1986) found that patients could "rest better in a hospital environment with varied patterns of auditory input (Music, TV) than with quiet ambiance. (Rollins, 2011, p. 86)"

Most healthcare facilities recognize that antiseptic smells should be decreased, and that the smell of food from a dining area can cause unpleasant experiences. Neumann contends that specific aromas may directly modify health conditions. For example, Lavender

smell is reputed to decrease insomnia, and lemon smell may increase the efficiency of white blood cells, although this is a controversial finding (Neumann, 1995). In addition to the quality of air in healthcare settings, air temperature, air ions, humidity, and thermal comfort are also important factors in the well-being of users in a healthcare facility (Hawkins, 1981; Malnar, 2004).

Enhancing user's sense of control

Privacy

Ulrich (1991) stresses that "lack of control is a pervasive problem that increases stress and adversely affects wellness." Patients and visitors' sense of control can be improved by maintaining their privacy in the healthcare main lobby. Several design strategies elevate privacy for users, including the placement of movable seating and tables, use of walls and partitions, and use of acoustic panels and sound absorbing materials.

Figure 2.20. *Privacy panels at Palo Alto Medical Foundation San Carlos Center admission department (Source: From a website published in Interior design magazine, Copyright 2016, Bruce Damonte, Design by NBBJ)*

In particular, the admitting area (Figure 2.20) should consider the need for privacy and confidentiality, because it is there where patients may need to report health-related personal information, such as health history, financial status, and current health problems

(Carpman & Grant, 1993). In a study of the relationship between behavioral needs and design in 26 different admitting areas, it was found that the overall design of the area and the proximity of spaces to one another affected perceived privacy (Valenta, 1981). That study also found that visual barriers such as partitions and private rooms provided a symbolic sense of confidentiality, even though acoustic privacy was lacking. The perception of visual and acoustical privacy is also needed in interview areas, staff working areas, and waiting areas (Carpman & Grant, 1993; Malkin, 1991; Valenta, 1981).

Physical activities

The healthcare main lobby is usually the first place seen by people who visit the facility. Numerous people share this space, inpatients or outpatients can walk through it, visitors can wait for patients or for those wishing to avoid waiting areas on inpatient floors children may accompany visitors, and staff and others with business in the facility may use the space (Carpman & Grant, 1993). Patients and visitors often experience feelings of anxiety and depression resulting from stressful situations (Brown, et al., 1997; Dunn, et. al., 2001). Ulrich (1991) suggests that incorporating spaces for mild exercise such as wide corridors, a walking garden, and attractive and easily accessible staircases, can mitigate such feelings. It is important to offer high visibility and accessibility to such spaces, and the facility can also provide positive aids in the form of graphic images such as posters, signage, pamphlets, and video screen information. Providing users with options for navigating the environment can not only create positive user experiences in the facility, but also promote a healthier lifestyle.

Aspects of social support

Furniture layout

A post-occupancy evaluation (POE) study of three hospital lobbies in Canada examined a number of environmental design problems. One common problem for groups is the need for furniture that can both be flexibly arranged into conversation groups while also providing privacy (Carpman & Grant, 1993; Hamilton, n.d.).

Furniture arrangements and space layouts affect levels of social interaction. Individuals with high social support experience less stress and achieve higher levels of wellness (Holahan, 1982; Sommer & Ross, 1958; Ulrich, 1991).

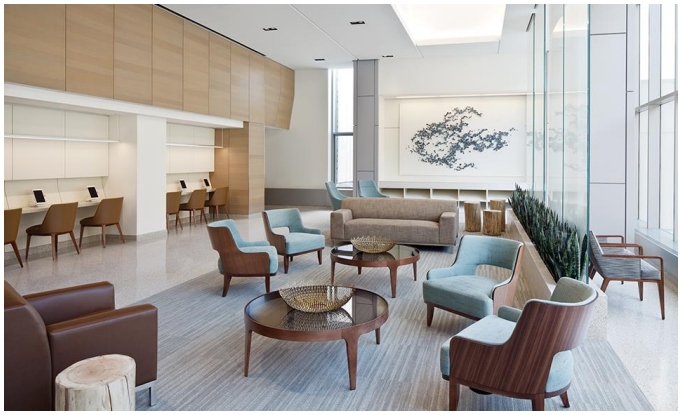


Figure 2.21. *Various furniture layout at Memorial Sloan Kettering Cancer Center main lobby: West Harrison (Source: From a website published in Contract magazine, Copyright 2015, Ron Blunt, Design by EwingCole)*

Carpman & Grant (2004) made several recommendations regarding seating arrangements that can improve social interaction. First, seating should enable people to arrange themselves into different-sized social groups (Figure 2.21). Second, seating should enable people to comfortably position their bodies for conversation. Third, the waiting area should provide wheelchair spaces. Fourth, the seating area near the entrance should be arranged so that people inside the area can see cars driving up to drop-off and pick-up areas. Ulrich (1991) further emphasizes that an interior arrangement that enforces social contact but denies privacy will be stressful and work against wellness.

Space configuration

The main entry lobby of a healthcare setting is considered to be a major social space, and the space configuration of such a lobby has an important role not only with respect to social interaction and wayfinding issues, but also with respect to evoking emotional responses from users (Figure 2.22). Ulrich stressed that outdoor and indoor healing gardens, as well as seating and waiting areas, should also be maintained throughout the campus of a healthcare facility to encourage social interaction (Ulrich, 1991). Parsons (1991) provides some evidence that variety in building spaces, such as visually accessible versus visually enclosed spaces, are important for optimal emotional and cognitive function. Similarly, spatial variation in the environment is related to reduction in depression and social withdrawal (Barwley, 1997; Parsons, 1991; Schweitzer, et. al., 2004).

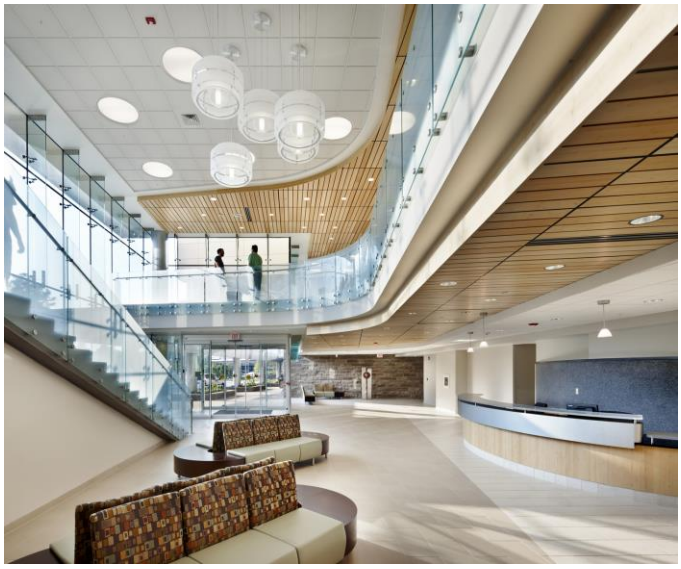


Figure 2.22. *High ceiling, open space at WakMed Health and Hospitals Raleigh Campus – Patient tower main lobby (Source: From a website published in Interior Architecture & Design, Copyright 2016, Brian Strickland, Design by Interior Architecture & Design)*

Enhancement of safety and security

Entry access control

According to family-centered care philosophy, many people enter healthcare facility lobby areas for purposes related to their family members or loved ones and entry point demands issues of security and safety. “Some of our patients are coming in for the fight of their life. I don’t want security’s role to be a barrier for that,” (Facilitating Better Healing with Visitor-Friendly Security, n.d., pp. 13) says Ralph Nerettle, Manager of Security Services at Dana-Farber facilities.

Healthcare facilities must maintain a balance between providing a welcoming and transparent environment for its users and the community, providing easy access to the facilities, and establishing proper security strategies (Table 2.9) for protecting the people and assets in the building (Meyer, 2014).

Table 2.9. (Source: Modified from a paper published in Ann Timme, 2014)
Security strategies at the main lobby area

Category	Detail
Secure area	Such as offices, departmental entrances, back-of-house operations areas, chapels, gift shop, cafeteria and other rooms need standalone or networked electronic locks and/or credential readers including time zones, audit trails and other basic access control attributes
Less populated area	Keep people safe where they are, control the movement of the potential perpetrator
Elevator	Use access control to restrict elevator access to patient and other floors that require privacy
Egress	Clear and safe egress must be furnished as the will be the main exit point in the case of an emergency
Openings	Ensure that openings operate and close properly
Staff	Staff should be trained, so they do not prop open doors, which reduce the security of the entire facility
Visitor management system	Provide visitors and ID and/or lists the purpose of their visit
Video camera	Video camera gives security personnel a real-time view of what is happening

Cleanness

As stated earlier, the main entry lobby is the first place users see when entering a facility, so facility management department should give priority to remodeling, cleanness and maintenance budgets to make the welcoming area look fresh and sparkling clean (Meyer, 2014). According to researchers that measure users' experience, one factor that can impact how a healthcare facility ranks among a user group is the perception of its cleanness (Sofaer, et al., 2005, Coulter, et al., 2009). Cleanness and maintenance are important not only because of the image created for a healthcare facility but also because of its importance in helping to prevent the spread of diseases (Healthcare Facilities Today, 2013). There are several approaches to improving the cleanness of the main lobby through design decisions. Designers should pay close attention to the materials and surfaces used to ensure that they are easy to clean and that the level of cleanness will be easy for users to see (Ellis, 2016, January). In addition, selecting rounded edges on furniture and minimizing seams in flooring and top surfaces can increase the effectiveness of cleaning efforts (Ellis, 2016).

In 2010, Cleveland Clinic's Office of Patient Experience published a newsletter describing their efforts toward improving user experiences. Some examples of practices demonstrating the clinic's commitment to the cleanness of the facility that can be utilized in designing and managing the main entry lobby are the following: First, the Environmental Service (EVS) Department conducted a deep cleaning of nursing units, including some updates related to electricity, plumbing, machines, and carpentry. This was called the department's 'Picture Perfect' cleaning program. Second, each EVS employee receives continual feedback regarding the facility's cleanness scores, as reported in HCAHPS. Finally, EVS has replaced

some cleaning products with other eco-friendlier types that are safer for the environment (Cleveland Clinic, 2010).

Hand washing and hygiene

Figure 2.23. *Hand hygiene visual cue (Source: Modified from a paper published in CDC)*

Hand hygiene is the most important means of preventing the transmission of HAIs (Boyce & Pittet, 2002; Birnbach, et al., 2012; World Health Organization, 2009). HAIs are responsible for an estimated $28,000 ~ $127,000 per infection as well as to adverse effects on outcomes, increased hospital lengths of stay, and lowered scores on patient satisfaction surveys (Institute for Healthcare Improvement(IHI), n.d.).

Hand hygiene compliance is usually lacking in hospital lobbies (Birnbach et al., 2012). To achieve the best outcome for compliance with hand hygiene requirements, the authors suggest four strategies. First, visual cues should be provided to motivate people to comply (Figure 2.23). Second, alcohol-based hand sanitizers should be placed strategically, clearly visible and accessible to all visitors. Third, there should be warning signs specifically directed at visitors to explain the serious consequences of transmitting infections to patients and others. Finally, compliance should be mandated to ensure that visitors clean their hands at least once before leaving the lobby (Birnbach, et al., 2012).

Healthcare Design Evaluation Tools and Guidelines

This section introduces six existing design evaluation tools, standards, and guidelines related to creating wellness design evaluation criteria and defining design features for a healthcare facility's main entry lobby. Many healthcare facilities are undergoing renovation or replacement with an evidence-based POE that examines not only enhancing healthcare outcomes but also improving user satisfaction within a healthcare environment design (Joseph, 2012).

The American Evaluation Association (AEA) task force recommends five guiding principles for evaluators (Table 2.10). The first principle, systematic inquiry, suggests that evaluations must be conducted in a systematic and data-based manner. This systematic inquiry forms the basis for selecting design evaluation tools and design guidelines for the research. Scherier, et. al., (1998) elaborates this principle. First, to increase the credibility of the information, evaluations should maintain the highest appropriate standards, whether the research is quantitative or qualitative. Second, evaluators should determine the limitations, weaknesses, and strengths of the evaluation and present the results to the client. Third, evaluators should communicate the values, assumptions, theories, methods, approaches, results, and analysis related to the study, to allow others to understand, interpret and critique their work.

Table 2.10. (Source: Modified from a paper published in Scherier et al., 1998)
Five guiding principles for evaluators

5 Principles	Detail
Systematic Inquiry	Evaluators conduct systematic, data-based inquiries about whatever is being evaluated
Competence	Evaluators provide competent performance to stakeholders
Integrity/Honesty	Evaluators ensure the honesty and integrity of the entire evaluation process
Respect for People	Evaluators respect the security, dignity, and self-worth of the respondents, program participants, clients, and other stakeholders with whom they interact
Responsibilities for Public Welfare	Evaluators articulate and take into account the diversity of interests and values that may be related to the general and public welfare

In this study, the following six existing evaluation tools, standards, and guidelines were selected to assist in creating and developing design evaluation criteria for the main entry lobby of a healthcare facility.

- Patient Room Post Occupancy Evaluation Tool (PRPOE) from The Center for Health Design (CHD)
- Clinic Design Post Occupancy Evaluation Toolkit (CDPOE) from The Center for Health Design (CHD)
- Guidelines for Design and Construction of Health Care Facilities (GDCHF) from The Facility Guidelines Institute (FGI)
- LEED V2009 for Healthcare (LEED + HC) from the U.S Green Building Council (USGBC)
- Building Occupants Survey System Australia (BOSSA) from Building Research & Information (BRI)
- Centers for Disease Control and Prevention Work Health Score Card (CWHSC) from the Centers for Disease Control and Prevention (CDC)

These six evaluation tools and guidelines are chosen on the following basis:

1. The POE tools and guidelines are related to the built environment, including interior spaces.
2. The POE tools and guidelines are not specific to a main lobby (waiting area, public space) in healthcare design environments.
3. The POE tools and guidelines are related to human health and wellness.

4. The POE tools and guidelines have been updated before 2014.

5. The POE tools and guidelines are open to the public.

Table 2.11. A summary of different POE tools and guidelines for evaluating the main entry lobby of a healthcare facility

	PRPOE	**CDPOE**	**GDCHF**
Published Organization	CHD	CHD	FGI
Country	The United States	The United States	The United States
Start/ Update	2011/ 2015	2011/ 2015	1947/ 2014
Field of application	Healthcare (intensive care unit patient room)	Healthcare (outpatient clinics)	Any types of healthcare built environments
Format	Score based a POE tool in Microsoft Excel (checklist)	Score based a POE tool on PDF (checklist)	Guidelines on paper (standards)
Key information	1. Structure and format of the POE tool (category, EBD goals, score system, and assessment aids) 2. Applicable healthcare design (patient room) 3. Focused on quality of care and patient experience	1. Structure and format of the POE tool (principle, design features, and score system) 2. Applicable healthcare design (outpatient clinic) 3. Focused quality of care and patient experience	1. Applicable federal guidelines of healthcare facility design 2. Reviewed different types of healthcare facility

(Continued)

Table 2.11 (continued)

	LEED+HC	**BOSSA**	**CWHSC**
Published Organization	USGBC	BRI	CDC
Country	The United States	Australia	The United States
Start/ Update	2009/ 2014	2010/ 2016	2008/ 2014
Field of application	Healthcare (sustainable design)	Any types of built environments	Any types of worksite
Format	Score based an evaluation tool on paper	Multidimensional POE tools	Score based an evaluation tool on paper (score card)
Key information	1. Applicable sustainable design strategy in healthcare design 2. Architecture and community focused health and wellbeing	1. General categories for interior space design POE 2. Applicable outside of the U.S	1. Applicable other than built environment focused evaluation. 2. Closely related to human health and wellbeing 3. Federal level assessment

Summary

In this chapter, six questions identified through the literature review have been addressed in answering the research question: 1) What is meant by wellness? 2) What are the health goals and trends in human wellness of the U.S. and of Iowa? 3) How are theories and studies of the areas connected to health and wellness in healthcare design? 4) What design issues in healthcare environments impact wellness of patients and families? 5) How can we resolve design issues related to the main entry lobby of a healthcare facility? and 6) How can we improve the user's experience, and what evaluation tools and guidelines are appropriate for assessing the main entry lobby of a healthcare facility?

At the beginning of this chapter, the concept of wellness was reviewed by comparing the definitions of health, health-related quality of life, population health, well-being, and wellness. Although the concept of wellness has been considered to be synonymous with well-being, it is more likely to be used as nearer to the meaning of health (physical, mental, and social), including spiritual, intellectual, and environmental aspects, so the study focuses on the empirical meaning of wellness from the perspective of human health.

According to the HHS Strategic Plan and HP2020, advancing the health and well-being of all the people of the U.S is a primary goal. As reported by the CDC (2014), the state of Iowa has a mean of well-being index similar to that in the U.S, so a study on investigating Iowan's wellness is valuable because it tends to represent the mean wellness of the U.S population. To improve human wellness in a built environment, protocols, standards, and guidelines are developed at an organizational level after which designers test the evidence-based outcomes in various fields of community design and, more importantly, in healthcare design (ASID, n.d.).

The next section of this chapter describes theories and studies concerned with health and wellness in healthcare environments. Most such theories are usually based on the assumption that body, mind, and the environment are interconnected and interact with one another (Steelcase, 2014). Recent studies in environmental psychology reveal that stress in a healthcare environment is a major problem that works against wellness (Ulrich, 1991). Creating a healing environment, adopting supportive design theory, and applying active design guidelines in healthcare facility design can minimize the stress experienced by facility users.

The literature review examined the five design-related issues that impact wellness of a healthcare facility user. In healthcare facility design, positive user experience is a basic consideration in planning the facility (Arneill & Devlin, 2002), and lack of positive distractions, of a sense of control, of social support, or of a feeling of safety and security can cause negative user experiences that impact their overall wellness in healthcare environments, according to previously reviewed theories (Carpman & Grant, 1993; Shepley, 2004; Steptoe & Appels, 1986; Ulrich, 1981).

The author also focuses on identifying the design elements likely to promote users' wellness in the healthcare main entry lobby. To make the user experience more positive, designers should consider a user's experiences in the main entry lobby, check-in, waiting, and wayfinding. As previously mentioned, positive distractions, sense of control, social support, and safety and security should be present if the overall wellness of the user is to be promoted. To provide optimal positive distraction, elements of nature, such as an outside view, water features, green materials, natural light, nature themed artwork, healing gardens, and pleasant sensory aspects can be important design features. Visual and auditory privacy

are essential to design considerations, and spatial options for physical activities are other design features for enhancing the user's sense of control. Implementing a flexible furniture layout and providing different sizes and styles of furniture can accommodate better social outcomes in the waiting area. Enhanced safety and security through controlling entry access, maintaining cleanness, and adding hand wash and hygiene stations, can also directly affect the user's physical, emotional, and social wellness.

In the following chapter the author introduces an assessment methodology of POE to identify design issues and select existing tools and guidelines for creating and developing new design evaluation criteria for the main entry lobby of a healthcare facility. Such criteria are based on key information achieved through a mixed method of qualitative and quantitative study.

CHAPTER III

METHODOLOGY

Overview

This chapter provides documentation for the method and for research information used in the research.

This research used a mixed method of combining qualitative and quantitative methods. According to Creswell & Clark (2007), mixed methods research combines quantitative and qualitative approaches to provide a better understanding of research problems. Others have explained that a mixed method study is an experiment in which quantitative measures assess the impact of treatment on an outcome (Brett, et al., 2002).

The mixed methods approach is first comprised of content analysis of existing healthcare design evaluation tools and guidelines representing qualitative research, followed by a survey based on a quantitative study of user's experience in the main entry lobby. The author believes that mixed method research best addresses the following research questions:

1. What wellness design criteria could be addressed and which design features should be assessed for evaluating user-centered wellness design experience in the main entry lobby of a healthcare facility?
2. How important are the design features in affecting a user's experience and how can they impact the user's perception of physical well-being, emotional health, and social interaction in the main entry lobby of a healthcare facility?
3. How do various user groups representing different demographic factors such as gender, students vs. non-students, domestic vs. international background, etc., and

their visiting patterns, such as inpatient facilities vs. outpatient facilities, length of stay, and frequency of visit, etc., experience the concept of wellness in the main entry lobby of a healthcare facility?

The first part of the research study consists of analyzing six existing evaluation tools and design guidelines related to the healthcare design and the POE of healthcare facilities. This activity is intended to provide a response to research question 1. The purpose of analyzing existing documents is to identify wellness design criteria and design features to help in development of a new set of design evaluation criteria.

The second part utilizes a questionnaire and statistical analysis related to determining how the wellness design criteria and design features are valuable to the user's experience. The purpose of the survey and statistical analysis is to answer both research question 2 and research question 3.

Content Analysis

This section describes conduct of qualitative analysis by reviewing the current evaluation tools and design guidelines used to create wellness design assessment criteria for the main entry lobby of a healthcare facility. As a qualitative research technique, content analysis is very useful for documenting trends over time (Hsieh & Shannon, 2005). Cavanagh (1997) presented content analysis as a flexible method for analyzing text data. Content analysis is a way of studying existing written documents and records, whether public or private, including existing evaluation tools and design guidelines (Esterberg, 2002). Others have described content analysis as analytic approaches ranging across impressionistic, intuitive, and interpretive areas (Rosengren, 1981).

Content analysis involves the following steps. First, selected guidelines and tools will be reviewed to filter for criteria related to a user's wellness experience in the lobby of a healthcare facility. Second, major criteria related to a set of design features will be identified and a questionnaire will be developed to explore spcific design issues per criterion. To create a valid evaluation tool, the process should be systematic, and the evaluation should maintain the highest appropriate standards (Scherier, et. al., 1998). Microsoft Excel will be used for coding and data cleanup and for generating charts and graphs.

Existing evaluation tools and guidelines were first reviewed to analyze the major criteria applicable to a healthcare main entry lobby. These criteria were then re-examined for the purpose of highlighting issues concerned with a user's wellness experience. Topics related to a user's wellness experiences in the entry lobby of a healthcare facility were thus specified.

The selected major criteria were categorized into five wellness design criteria (user experience, positive distractions, sense of control, social interaction, and safety and security) and sub-categories wherever possible. Subsections that could not be coded into one of the five categories were coded with another label that captured the other sub-categories. After coding, all subsections were rearranged by sub-category and combined into a phrase to cover the selected evaluation tools and design guidelines.

The content analysis is conducted based on the following protocols.

1. The POE tools and guidelines are related to the built environment, including interior spaces.
2. The POE tools and guidelines are not specific to the design of main lobby (waiting area, public space) in healthcare environments.

3. The POE tools and guidelines are related to human health and wellness.
4. The selected POE tools and guidelines were the ones updated before 2014.
5. The POE tools and guidelines are open to the public.

Although the method can provide ideas essential to the creation of new wellness design evaluation criteria, the selected tools and guidelines cannot comprise every single design element of the main entry lobby of a healthcare facility. The selected design features in the content analysis would also not be applicable to the design of all areas of a healthcare facility because the criteria focused only on a user's wellness experience in the main entry lobby of a healthcare facility.

Survey

Through the literature review and content analysis, the author created the wellness design evaluation criteria used as a basis for generating the survey questions. The purpose of the survey (APPENDIX C) and statistical analysis that comprised the quantitative research methods, was to test the criteria related to the user's healthcare facility experience. Twenty design features will be investigated by the survey to obtain responses that are strongly relevant to users and provide information on how physical well-being, emotional health, and social interaction are affected by a user's experience in the main entry lobby of a healthcare facility.

The research study will examine user's healthcare main lobby experience as affected by gender, educational level, design experience, geographical background, type of healthcare facility, frequency of visit, duration of visit, and purpose of visit.

The following 20 design features will be investigated: 1. entrance experience, 2. entry vestibule experience, 3. access control system, 4. basic space program, 5. additional space program, 6. accessibility to other space, 7. space configuration, 8. environmental support for physical activities, 9. variety of furniture, 10. nature elements, 11. controlled lighting system, 12. visual appeals, 13. visual and auditory privacy, 14. perception of noise, 15. positive sound distractions, 16. air comfort and freshness, 17. user controlled environments, 18. cleanness and maintenance, 19. infection control system, 20. information for healthier life.

Hypothesis of the Survey

The following hypotheses were developed to answer the second research question – How important are the design features with respect to user experience and how can they impact a user's perception of physical well-being, emotional health, and social interaction in a healthcare main entry lobby?

1. Optimizing positive distraction is the most important wellness design evaluation criter ia for the design of the main entry lobby of a healthcare facility.

2. There is a high correlation between the importance of design features and their impact on the three types of wellness (physical well-being, emotional health, and social inter action) related to those features.

The following hypotheses were developed to answer the third research question - How do various user groups, differing in demographics, e.g., gender, students vs. non-students, domestic vs. international background, and their visiting patterns, e.g., inpatient

facilities vs. outpatient facilities, length of stay, and frequency of visit, experience the concept of wellness in the main entry lobby of a healthcare facility?

3. User experience will vary across users' visiting patterns (type of facility, frequency of visit, duration of visit, and purpose of visit) depending on design features in a healthc are main entry lobby.

4. User experience will vary across user's demographic differences (male vs. female, de sign vs. non-design major, and domestic vs. international background) depending on t he design features in a healthcare main entry lobby.

Population of the Survey

The total number of subjects was N=275, all over 18 years old with at least one experience in visiting a healthcare facility during the previous 12 months in the state of Iowa.

Choosing an appropriate population for participation in this survey is important. As previously mentioned, the perception of wellness by Iowans, specifically students, is valuable because they represent a sizable population (approximately 33,000) with diverse healthcare experiences (hospital, ambulatory care, residential, or others). Leedy and Ormrod (2005) suggested that individuals enrolled in a university are in a formative period of their lives in which daily influences greatly alter their perceptions of the environment and society.

A random sample of 275 students enrolled at the university was obtained. The number was obtained that confidential interval is six on 95% confidence level out of total sampling population of 33,195 student emails from Registrar's office. Another sample was obtained by snowball sampling for a non-university student group. Such a sampling, a non-probability sampling technique that recruited subjects from the researcher's group of

acquaintances, is often used in social science research and statistics research. Each of the 18 subjects obtained in the second sampling had either a design related background, a graduate-level degree, or working experience related to design.

Instruments for the Survey

The survey (APPENDIX C) was an online survey that could be accessed through the Internet at Qualtrics.com. Utilizing an online questionnaire is important for:

1. reaching the selected demographic group with a method more familiar than traditional methods such as a mailing or a survey at a specified site
2. accessing a variety of individuals with various healthcare facility experiences in Iowa
3. identifying subjects' attitudes toward their healthcare design experiences
4. conducting the survey promptly with better-performing measurement tools for obtaining data

The data were collected by a questionnaire covering 20 design features, five items related to demographic information, and six overall healthcare facility experiences. The majority of the questions were to be answered on a Likert-type scale. There were two major types of questions. One asked about the importance of the design features measured using a typical five-level Likert scale, while the other asked about the physical, emotional, and social impact of the design features measured on a four-level Likert scale (negative impact, no impact, favorable impact, best impact).

The data was analyzed quantitatively using IBM SPSS and Microsoft Excel. Microsoft Excel was utilized for coding and data cleanup and generating charts and graphics.

Statistical Analysis with IBM SPSS was used for calculating frequencies of the results, means, correlations between related design features, and T-tests and ANOVA to compare relationships of design features with demographic information and overall healthcare facility experiences.

Testing Procedures and Method of the Survey

The questionnaire was pilot tested before the actual online survey was conducted. The pilot test was conducted with university students not subsequently involved in the actual survey. Through the pilot test, the time taken in completing the questionnaire was measured, and typos, grammatical errors, and ambiguous questions were revised to achieve a more reliable survey.

The survey was available 24 hours a day from July 1 to July 31 of 2016. Preparation for the survey could begin after human subjects' training from Iowa State University had been received. After institutional review board approval (APPENDIX A) had been obtained, administration of the survey began. The survey began by asking participants to read the informed consent document (APPENDIX B) before deciding whether to participate in the survey. After indicating their agreement, participants could initiate the survey process.

The survey took approximately 20 minutes to complete. If participants were uncomfortable about answering a question or a question was not applicable to them, they had the option of skipping that question. However, there was no "back" button to allow participants to change their initial answer, or to obtain a better understanding of some part of the survey. Since participants were not limited to students at Iowa State, respondents were divided into two sets, ISU students and non-ISU students (as verified in the screening

procedure). The screening criteria were stated in two places, in an email invitation to participate in the survey and in the actual questionnaire.

10,000 ISU students were randomly selected from a list obtained from the ISU registrar's office. The online survey using Qualtrics was administered, and participants were asked to rate 20 features of the design of the main lobby of a healthcare facility. The only demographic information requested was related to gender, classification, and college. An email invitation sent to the randomly selected individuals included elements of the informed consent form and a link to the survey. The questionnaire began with questions regarding the willingness of the student to participate in the survey. If they did not want to participate, they were led to the end of the survey (a thank-you note). Those completing the survey had an opportunity to be included in a drawing for $25 Amazon gift cards to be given to 5 randomly selected participants. At the end of the survey, participants were asked to state their email addresses if they wished to be included in the drawing, and gift cards were emailed to the winners.

For the Non-ISU students, snowball sampling along with a "word of mouth" method was used to recruit participants. Friends and acquaintances were informed of the availability of the survey, and a link to the survey was sent to those willing and qualified to participate. All questions were the same for both groups, except that questions related to education were asked differently (i.e., highest level of education attained, design or non-design background). Original data were downloaded from Qualtrics in Excel format and stored on the researcher's personal password-protected computer. Data was analyzed using SPSS and reported in aggregate to protect the identity of respondents.

The results were analyzed statistically to test the hypotheses. The two sets of original Qualtrics data, initially coded as numeric values, were downloaded in Microsoft Excel, CSV format. The two sets of survey data were combined in an Excel file with consecutive subject numbers, and the original data codes were then converted to the same format (APPENDIX E). The coded data were first cleaned up by the researcher to remove unusual responses and then cleaned up once again in IBM SPSS. To test hypothesis 1, the mean value of importance, physical, emotional, social wellness of each design feature was analyzed using Excel and a frequency test in IBM SPSS, and the mean value of importance and mean value of user's impact on the three types of wellness of the design features were compared and presented in the form of a bar chart. To test hypothesis 2, Pearson Correlation tests from IBM SPSS were used. To test hypothesis 3, an ANOVA from IBM SPSS was needed because means of more than three items were compared. Finally, to test hypothesis 4, a T-test and IBM SPSS were needed to compare means of two items.

CHAPTER IV

RESULTS

Overview

The objective of the thesis is to create and validate wellness design evaluation criteria for the main entry lobby of a healthcare facility. This chapter describes the outcomes of the data collection and analysis. Because the study uses a mixed-method approach, a combined qualitative and a quantitative research method, the results and analysis of the two sets of data are individually presented. The results are laid out in accordance with the two approaches, content analysis and survey, to correspond to the research questions.

Results of Content Analysis

The primary goal of the content analysis was to gather information regarding existing evaluation criteria and design guidelines appropriate to the creation of a new wellness design evaluation tool for a healthcare facility's main entry lobby. It is important to conduct a systematic analysis with respect to existing evaluation criteria and guidelines because the results may provide information necessary for creating and developing the new wellness design evaluation criteria to be proposed in the next chapter.

The method of content analysis uses the text of existing evaluation criteria and guidelines so that the results can be analyzed qualitatively. The data collected from the content analysis were analyzed in tabular form, and this section presents the significant findings of the content analysis showing how the results are utilized both in the survey and in the proposed evaluation tool.

There were five steps in the content analysis.

Step 1 was to identify major criteria related to both the healthcare main lobby area and the wellness concept by reviewing all major criteria of six existing evaluation tools and sets of design guidelines.

Step 2 was to reorganize the selected major criteria consistent with the five wellness design criteria defined in Chapter 2. The first goal of content analysis step 2 was to form a basis for analysis of specific criteria and design features. The second goal was to identify which existing evaluation tools and guidelines are correlated with the five wellness-design criteria. The major criteria could overlap. For example, 'reduce patient pain, stress, anxiety and delirium' in PRPOE can be applied to wellness design criteria 1, improvement of user's experience, and to wellness design criteria 2, optimal positive distraction.

Step 3 was to categorize specific criteria of the selected major criteria into 20 design features. In this step, the researcher numbered the specific criteria as to category number.

Step 4 was to reorganize the specific criteria into 5 wellness design criteria and 20 design features, to allow a reader to recognize which design feature is associated with which specific criteria. The category numbering system was used for the reader's convenience in referring to design features associated with each criterion.

Step 5 was to summarize each of the specific criteria into a phrase. The summaries of the design features were utilized both in the online survey for determining the participant's perception of the design feature and in the proposed wellness design evaluation tool.

Table 4.1 presents the results of reviewing the major categories of the six content areas. The purpose of the first step of the content analysis was to identify which major categories are related to the main entry lobby design and the wellness concept.

First, the major categories of the Patient Room Post-Occupancy Evaluation tool (PRPOE) associated with both the main entry lobby design and wellness concept were related to: 1) reducing risk of contamination, 2) improving hand sanitation, 3) reducing patient pain, stress, anxiety, and delirium, 4) enabling and enhancing patient sense of control, 5) improving patient engagement, 6) improving patient satisfaction, 7) improving comfort, 8) reducing noise, 9) respecting privacy, and 10) enhancing sustainability.

Second, the major categories of the Clinic Design Post-Occupancy Evaluation toolkit (CDPOE) were associated with both the main entry lobby design and the wellness concept and were related to: 1) enhancing privacy, 2) improving access and wayfinding, 3) enhancing the waiting experience, 4) reducing patient anxiety, 5) improving patient flow throughout, 6) providing a healthy environment, 7) enhancing security, and 8) incorporating state-of-the-art technology.

Third, the major categories of Guidelines for Design and Construction of Healthcare Facilities (GDCHF) associated with both the main entry lobby design and the wellness concept are: 1) patient support service, 2) general support services and facilities, and 3) public and administrative areas.

Fourth, the major categories of LEED V2009 for Healthcare (LEED+HC) associated with both the main entry lobby design and the wellness concept are: 1) materials and resources, and 2) indoor environmental quality.

Fifth, the major categories of Building Occupants Survey System Australia (BOSSA) associated with both the main entry lobby design and wellness concept are: 1) spatial comfort, 2) indoor air quality, 3) personal control, 4) noise distractions and privacy, 5)

connection to outdoor environment, 6) building image and maintenance, 7) thermal comfort, and 8) visual comfort.

Finally, for the CWHSC, the wellness concepts applied to the main lobby design are related to: 1) nutrition, 2) physical activity, and 3) weight management.

Table 4.1. Reviewing major categories of the wellness concept applied to the lobby design (Content analysis-step 1)

PRPOE			CDPOE			GDCHF		
EBD goals	**Lobby**	**Wellness**	**Design principles**	**Lobby**	**Wellness**	**Space planning**	**Lobby**	**Wellness**
Improve mobility and reduce falls		○	Enhance Privacy	○	○	Nursing units		○
Reduce risk of injury		○	Improve access and wayfinding	○	○	Diagnostic and treatment locations		○
Reduce risk of contamination	○	○	Enhance waiting experience	○	○	Patient support service	○	○
Improve hand sanitation	○	○	Enhance communication/ interaction between staff and patient		○	General support services and facilities	○	○
Provide safe delivery of care		○	Enhance communication/ teamwork between staff members		○	Public and administrative areas	○	○
Provide efficient delivery of care			Reduce patient anxiety	○	○	Design and construction requirements		
Improve communication		○	Reduce patient infection risk	○	○	Building systems		
Improve staff health		○	Reduce staff stress and improve job satisfaction	○				
Improve job satisfaction		○	Improve patient flow and throughout	○	○			
Reduce patient pain, stress, anxiety, and delirium	○	○	Reduce resource consumption					
Enable & Enhance patient sense of control	○	○	Improve recycling and reduce waste		○			
Improve patient engagement	○	○	Provide a healthy environment (reduce negative health effects)	○	○			
Improve patient satisfaction	○	○	Enhance security (patient staff facility)	○	○			
Improve family presence and engagement in patient care	○	○	Incorporate state-of-art technology	○	○			
Improve comfort	○	○						
Reduce noise	○	○						
Respect privacy	○	○						
Ensure durability	○							
Enable change readiness/ Future-proofing	○							
Enhance sustainability	○	○						
Provide return on investment								

(Continued)

Table 4.1. (continued)

LEED+HC			BOSSA			CWHSC		
Sustainable Topic	**Lobby**	**Wellness**	**IEQ dimensions**	**Lobby**	**Wellness**	**Health topics**	**Lobby**	**Wellness**
Sustainable sites		○	Spatial comfort	○	○	Organizational Support		○
Water efficiency			Indoor air quality	○	○	Tobacco Control		○
Energy and atmosphere		○	Personal control	○	○	Nutrition	○	○
Materials and resources	○	○	Noise distraction and privacy	○	○	Lactation Support		○
Indoor environmental quality	○	○	Connection to outdoor environment	○	○	Physical Activity	○	○
Innovative in design	○		Building image and maintenance	○	○	Weight Management	○	○
Regional priority credits			Individual space		○	Stress Management		○
			Thermal comfort	○	○	Depression		○
			Visual comfort	○	○	High Blood Pressure		○
						High Cholesterol		○
						Diabetes		○
						Signs and Symptoms of Heart Attack and Stroke		○
						Emergency Response to Heart Attack and Stroke		○
						Occupational Health and Safety		○
						Vaccine-Preventable Diseases		○
						Community Resource		○

The major categories of the design evaluation criteria and design guidelines were classified according to the wellness design criteria stated in Chapter 2, the literature review. Although a one-to-one classification couldn't be done, the major categories were examined multiple times to identify the various wellness design criteria and issues. Table 4.2. shows a new set of wellness design criteria resulting from the content analysis. These results were used as the basis for step 3 (APPENDIX D). The results of step 2 clearly indicate that that context of PRPOE, CDPOE, and BOSSA reflects the five wellness design criteria, while the major criteria of GDCHF, LEED+HC, and CWHSC can be partially applied to the five wellness design criteria.

Table 4.2. A new set of wellness design criteria and major categories (Content analysis-step 2)

	1 Improvement of user's experience	2 Optimal positive distraction	3 Enhancing user's sense of control	4 Aspects of social support	5 Enhancement of safety and security
PRPOE	Reduce patient pain, stress, anxiety, and delirium	Reduce patient pain, stress, anxiety, and delirium	Enable & Enhance patient sense of control	Increase patient engagement	Reduce risk of contamination
	Increase patient engagement	Improve patient satisfaction	Improve patient satisfaction	Improve comfort	Improve hand sanitation
	Improve comfort	Respect privacy	Respect privacy		
		Reduce noise			
		Improve comfort			
CDPOE	Enhance waiting experience	Enhance waiting experience	Enhance waiting experience	Enhance waiting experience	Enhance security (patient staff facility)
	Improve access and wayfinding	Reduce patient anxiety	Enhance Privacy		Reduce patient infection risk
	Incorporate state-of-art technology	Enhance Privacy			Enhance waiting experience
GDCHF	Functional program	Functional program	Functional program		Functional program
	Public and administrative areas				
LEED+HC	Sustainable sites	Indoor environmental quality	Sustainable sites		
BOSSA	Connection to outdoor environment	Connection to outdoor environment	Noise distraction and privacy	Spatial comfort	Building image and maintenance
		Thermal comfort	Visual comfort		
		Building image and maintenance	Personal control		
		Visual comfort	Spatial comfort		
		Indoor air quality			
CWHSC	Physical Activity		Nutrition		
	Nutrition		Physical Activity		
			Weight Management		

For example, the major criteria of PRPOE could be applied to meet all the wellness design standards, but the major criteria of LEED+HC was applied to only three of the wellness design criteria: improvement of user′s experience, optimal positive distraction, and enhance user's sense of control. It is difficult to apply the major criteria to the other two wellness design criteria: aspects of social support and enhancement of safety and security.

Table 4.3.A. Specific criteria of the wellness design features: Issue # 1. Improvement of user's facility experience (Content analysis step 4.1)

Wellness design criteria	Design features	Specifics	Category number
1. Improvement of user's experience	**01. Entrance experience**	Connection to parking - walk less than 3 minutes	CDPOE-22
		Bicycle storage and changing rooms	LEED+HC-03
	02. Entry vestibule experience	Public areas shall provide vehicular drop-off and pedestrian entrance, lobby, public toilet rooms	GDCHF-01
		Wheelchair storage area - provided out of the path of traffic	GDCHF-04
		Waiting areas for patients on stretchers should be located in a private zone	GDCHF-14
	03. Basic space program	Clear physical boundary - waiting/ registration area, main circulation hallway	CDPOE-19
		Lobby shall include a counter or desk for reception and information, public waiting area, public toilet facilities, access to make local phone calls, provision for drinking water	GDCHF-02
		Layout/ operational planning-enhance the satisfaction of users	GDCHF-06
		Public circulation and staff/patient circulation should be separated wherever possible	GDCHF-16
		Access to family areas outside of patient room	PRPOE-25
		Comfortable and flexible accommodation for families to rest or lie down	PRPOE-27
	04. Additional space program	Drinking water is easily accessible to all users	CDPOE-07
		Hard toys and books are available for children of different ages	CDPOE-08
		Information regarding waiting time/time	CDPOE-10
		Kiosks for information or registration are available	CDPOE-20
		Enough spaces are available to accommodate kiosks or other displays for information access	CDPOE-24
		Easy access to the Internet through wireless connection	CDPOE-25
		Provide a series of educational seminars, workshops, or classes on nutrition?	CWHSC-06
		Provide enclosed vending area	GDCHF-03
		Development density and community connectivity	LEED+HC-02
		Presence of clock and watch for patient's orientation with time	PRPOE-06
		Amenities as considered appropriate, such as power outlets, wireless connection, phones	PRPOE-13
		Patient access to electronic media for education and entertainment	PRPOE-24
		Wireless connectivity/ Cellphone access	PRPOE-26
	05. Accessibility to other space	Clear signage - location, languages, symbols are easily understandable	CDPOE-21
		Provide maps(floor plans) of the clinic are easy to understand	CDPOE-23
		Provide an exercise facility on-site	CWHSC-09
		Convenience store, gift shop	GDCHF-05
		Clarity of access (wayfinding) - clearly visible and understandable signage, symbols, landmarks	GDCHF-10
		A system of interior "landmarks" should be developed to aid users in cognitive understanding of destinations (water feature, major art, distinctive color)	GDCHF-11
		Connection to outdoors	BOSSA-12
		Direct exterior access for patients	LEED+HC-05

Table 4.3.B. Specific criteria of the wellness design features: Issue # 2. Optimal positive distraction (Content analysis step 4.2)

Wellness design criteria	Design features	Specifics	Category number
2. Optimal positive distraction	**06. Nature elements**	External view	BOSSA-10
		Access to daylight	BOSSA-11
		Windows and/or skylight provide plenty of direct or indirect natural light	CDPOE-11
		Indoor plants, outside nature/gardens, artwork, or other pleasant stimuli are visible for users	CDPOE-16
		Light and views - use of natural light, illumination, and views in the physical environment	GDCHF-07
		Provide a garden or other controlled exterior space that is accessible to building users	GDCHF-08
		Daylight and views - daylight	LEED+HC-07
		Daylight and views - views	LEED+HC-08
		Patient has access to views of nature	PRPOE-01
		Large windows for natural daylight and window views	PRPOE-05
	07. Controlled lighting system	Lighting	BOSSA-13
		Indirect lighting should be considered to reduce glare	GDCHF-09
		Lighting design that allows lighting variation for the purpose of maintaining patients' circadian rhythm	PRPOE-09
		Glare sources controlled to minimize patient discomfort	PRPOE-11
		Glare controlled	PRPOE-20
	08. Visual appeals	Building aesthetics	BOSSA-20
		Attractive/inviting color/ materials	CDPOE-06
		Nature-themed artwork	PRPOE-02
		Physical environment is visually appealing	PRPOE-04
	09. Perception of noise	Sound masking - White noise and/ or music	CDPOE-03
		Noise-reduction - sound-absorbing materials	CDPOE-15
		Minimize site exterior noise method	GDCHF-12
		Noise should be minimized by the design the physical environment	GDCHF-15
		Noise reduction measures (sound-absorbing finish materials)	PRPOE-07
		Use of acoustic tiles	PRPOE-14
		Sound-absorbing construction and finish	PRPOE-15
		Technology to filter/mask external noise such as white noise machine	PRPOE-16
	10. Positive sound distractions	Soothing music and nature sound are accessible to patients	CDPOE-17
		Access to music	PRPOE-03
		Use of white noise/sound masking to reduce disruptions from noise	PRPOE-08
	11. Air comfort and freshness	Air movement	BOSSA-01
		Humidity	BOSSA-02
		Air freshness	BOSSA-03
		Air quality	BOSSA-04
		Temperature in winter	BOSSA-08
		Temperature in summer	BOSSA-09
		Air temperature, humidity, and flow speed are comfortable	CDPOE-05
		There is no unpleasant smell	CDPOE-09
		Weather protection - exit is well covered, protecting patients from weather	CDPOE-18
		Thermal comfort - design and verification	LEED+HC-06
		Ventilation and air conditioning system accommodating temperature differences during seasons	PRPOE-10

Table 4.3.C. Specific criteria of the wellness design features: Issue # 3. Enhancing user's sense of control (Content analysis step 4.3)

Wellness design criteria	Design features	Specifics	Category number
3. Enhancing user's sense of control	**12. Environmental support for physical activities**	Provide environmental supports for physical activity	CWHSC-08
		Post signs at elevators, stairwell entrances or exits and other key location that encourage employees to use stairs?	CWHSC-10
		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the benefits of physical activity?	CWHSC-11
		Provide free or subsidized body composition measurement, such as height and weight BMI score, body fat assessment followed by clinical referral when appropriate?	CWHSC-12
		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the risks of overweight or obesity?	CWHSC-13
	13. Visual and auditory privacy	Unwanted interruption	BOSSA-05
		Visual privacy	BOSSA-06
		Sound privacy	BOSSA-07
		Audio barriers at the registration	CDPOE-01
		Visual barriers between seating	CDPOE-02
		Privacy screens on registration kiosks	CDPOE-04
		Keep speech privacy in open-plan spaces	GDCHF-13
		Furniture configured to allow patient and family privacy	PRPOE-17
		Minimum perceived visibility from public areas	PRPOE-18
	14. User controlled environments	Personal control shading	BOSSA-14
		Degree of freedom to adapt	BOSSA-15
		Space for breaks	BOSSA-17
		Furniture is easy to be adjusted to improve the comfort of various users	CDPOE-12
		Provide dedicated space that is quiet where employees can engage in relaxation activities, such as deep breathing exercises?	CWHSC-16
		Place of respite	LEED+HC-04
		Flexible patient room layout accommodating care activities when patient needs change	PRPOE-19
		Patient has control over the environment, without compromising safety	PRPOE-21
		Adequate space for storage of personal belongings	PRPOE-22
	15. Information for a healthier life	A written policy or formal communication that makes healthier food and beverage choices available in cafeterias, snack bars	CWHSC-01
		A written policy or formal communication that makes healthier food and beverage choices available in vending machines	CWHSC-02
		Provide nutritional information for foods and beverages sold in worksite cafeterias?	CWHSC-03
		Make most of the food and beverage choices available in cafeterias be healthier food item?	CWHSC-04
		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the benefits of health eating?	CWHSC-05
		Offer or promote an on-site or nearby farmers' market where fresh fruits and vegetables are sold?	CWHSC-07
		Provide a series of educational seminars, workshops, or classes on weight management?	CWHSC-14
		Provide free or subsidized one-on-one or group lifestyle counseling for employees who are overweight or obese?	CWHSC-15

Table 4.3.D. Specific criteria of the wellness design features: Issue # 4. Aspects of social support (Content analysis step 4.4)

Wellness design criteria	Design features	Specifics	Category number
4. Aspects of social support	**16. Space configuration**	Interaction with colleagues	BOSSA-18
		Space for collaborate	BOSSA-19
		Design supports interaction between patients and staff	PRPOE-23
	17. Variety of furniture	Comfort of furnishing	BOSSA-16
		Size/layout to accommodate for different group sizes	CDPOE-13
		Furniture suitable for wide age and size variations	PRPOE-12

Table 4.3.E. Specific criteria of the wellness design features: Issue # 5. enhancement of safety and security (Content analysis step 4.5)

Wellness design criteria	Design features	Specifics	Category number
5. Enhancement of safety and security	**18. Access control system**	Appropriate access control system prevents unauthorized entry in to patient interaction space	CDPOE-29
		Protection devices, or safeguard staff in registration office	CDPOE-30
		Exit doors are automatically closed and equipped with alarms	CDPOE-31
		All public areas and the entrances are visible to staff members located in the registration	CDPOE-32
		Adequate exterior lighting in parking lots and entry points to the facility and appropriate reception/ security services are essential	GDCHF-17
	19. Cleanness and maintenance	Cleanness and Maintenance	BOSSA-21
		Cleanness of the space	CDPOE-14
		Easy to clean hard toys	CDPOE-26
		Smooth surface, with minimal perforations and crevices	PRPOE-28
		Minimal ridges or reveals that could serve as dust collectors	PRPOE-29
		Furniture is easy to clean and maintain	PRPOE-30
	20. Infection control system	Plenty of sinks and/or alcohol gel dispensers are located	CDPOE-27
		Separation or isolation of infectious patients	CDPOE-28
		Visual cues as reminders for hand washing/ sanitization	PRPOE-31
		Sinks and alcohol gel dispensers in visible and accessible locations	PRPOE-32

The content analysis results from step 3 are given in APPENDIX D. Because the results of step 4 of content analysis are identical to those of step3 except for the order of the category number, the researcher chose to present the results of step 4, and a reader can identify the origin of a specific criterion. For example, if a reader wants to determine the source of CDPOE-22, ‘connection to parking – walk less than 3 minutes’, he or she should look in APPENDIX D. Table 4.3.A shows that CDPOE-22 comes from the major criterion ‘improve access and wayfinding’ in CDPOE.

Tables 4.3.A to Table 4.3.E present the specific criteria of the existing evaluation tools and guidelines categorized by design features selected from the literature review and summarized in step 3 [APPENDIX D].

Table 4.4 Wellness design criteria (#1-5) and design features (#1-20) addressing specific design criteria and narratives

Wellness design criteria	Design features	Summary of specifics
1. Improvement of user's experience	**01.Entrance experience**	Covered area for vehicle drop off and pick up, proximity of parking lots, pedestrian entrance, clear signage, bicycle lots
	02.Entry vestibule experience	Wheelchair storage area that out of the path of traffic, view of drop off and pick up area, waiting area for discharge
	03.Basic space program	Information center, waiting area, public restrooms for male, female, and family, space for special group of people
	04.Additional space program	Kids area, multi-purpose lactation, place of respite, drinking water, local phone calls, power outlets, wireless connection, clock, waiting monitor, vending area, kiosks or other displays for information, clear signage and landmark for wayfinding
	05.Accessibility to other space	Cafe, gift shop, book store, chapel, business center, family library, exercise facility on-site, convenience store
2. Optimal positive distraction	**06.Nature elements**	Skylight, large windows for outside view, accessible gardens, indoor plants, water features
	07.Controlled lighting system	Overall experiences of lighting, minimizing glare on the floor, providing efficient lighting for the purpose of circadian rhythm, lighting aesthetic
	08.Visual appeals	Hospital brand, harmonized color, finishes, materials, nature themed artworks
	09.Perception of noise	Noise from equipment, sound of footsteps, murmur of conversation
	10.Positive sound distractions	White noise, access to soothing music, nature sound such as from water feature, or interior healing garden
	11.Air comfort and freshness	Comfortable air temperature, relative humidity, and flow speed, no unpleasant smell, air quality and freshness, appropriate temperature in season
3. Enhancing user's sense of control	**12.Environmental support for physical activities**	Highly visible staircase, interior healing garden, meditation garden, indoor climbing wall, space for free body fat assessment
	13.Visual and auditory privacy	Barriers in seating, privacy screens on registration area and/or kiosks
	14.User controlled environments	Adjustable furniture, adequate storage space for personal belongings, manual shading system
	15.Information for healthier life	Brochures, or pamphlets that address the benefits of health eating, overweight, or obese, nutritional information for foods and beverages sold in vending area, local farmers' market information
4. Aspects of social support	**16.Space configuration**	Visibility within space, spatial connectivity
	17.Variety of furniture	Variety of seating options for different group sizes, wide age groups and size variations
5. Enhancement of safety and security	**18.Access control system**	Protection devices, automatically closed door with alarms, safeguard staff, adequate exterior lighting
	19.Cleanness and maintenance	Cleanness of overall waiting area, quality of maintenance, public restroom experience
	20.Infection control system	Plenty of sinks and/or alcohol gel dispensers in visible and accessible locations, separated area for infectious visitors, visual cues as reminders for hand washing/ sanitation

A suggested summary of specific criteria is presented in Table 4.4. The use of terms and phrases varied among six different evaluation tools and design guidelines, so the researcher summarized each of the specific criteria into one phrase for which specific criteria was articulated in terms of design feature details and examples.

This summary of specific criteria was used for the online survey and for the creation of the wellness design evaluation tool in Chapter 5.

Survey Procedure and Results

The goal of the online survey was to identify participants' perceptions of the design features. This process is important because the results can be used to validate the design features included in the proposed wellness design evaluation tool.

The online survey consisted of three parts. At the beginning, four questions related to participants' visiting patterns, such as the type of healthcare facility where a participant had a memorable experience, frequency of visit, duration of visit, the role of their visit, were asked. There were two main questions related to the 20 design features: (1. entrance experience, 2. entry vestibule experience, 3. access control system, 4. basic space program, 5. additional space program, 6. accessibility to other space, 7. space configuration, 8. environmental support for physical activities, 9. variety of furniture, 10. nature elements, 11. controlled lighting system, 12. visual appeal, 13. visual and auditory privacy, 14. perception of noise, 15. positive sound distractions, 16. air comfort and freshness, 17. User-controlled environments, 18. cleanness and maintenance, 19. infection control system, 20. information for healthier life). The first question was about how the importance of design features in designing a healthcare facility's main entry lobby. For example, "how important are the

entrance experiences (e.g., covered area for vehicle drop off and pick up, proximity of parking lots, pedestrian entrance, clear signage, bicycle lots) of the main entry lobby of the healthcare facility to you?" Participants checked one of the five answers (not at all important, slightly important, moderately important, very important, extremely important). The second question was about the impact of the design feature on one's physical, emotional, or social wellness. For example, "what impact do the entrance experiences (e.g., covered area for vehicle drop off and pick up, proximity of parking lots, pedestrian entrance, clear signage, bicycle lots) have on your physical well-being, emotional health, and social interaction?" Participants checked one of the four answers (negative impact, no impact, favorable impact, best impact) of each wellness category. Finally, answers to three demography information questions, related to items like gender, design background or non-design background, and domestic background or international background, were obtained.

There were two sets of online survey, one for ISU students and the other for Non-ISU students. Conduct of the survey began on July 1st, 2016 and continued to July 31st, 2016.

The online survey questions were designed to identify the most and least important design features with respect to the design of the main entry lobby of a healthcare facility, and how each feature impacts users with respect to their wellness. It could also provide an understanding related to which wellness design criteria should be prioritized in the design of such a facility. At the end of the section questions are asked to determine the relationships among demographic groups, their visiting patterns, and the design features. These questions were used to verify the usefulness of design features to be included in the proposed wellness design evaluation tool in chapter six.

There were 331 respondents to the online survey, drawn from a population of 15,021, so the response rate was 2.2%. The valid number of subjects was 275 for the purpose of data analysis, with 58.2% female and 41.8% male (Figure 4.1.A).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Male**	115	41.8	41.8	41.8
	Female	160	58.2	58.2	100.0
	Total	275	100.0	100.0	

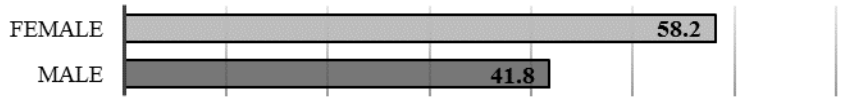


Figure 4.1.A. *Result of demographic question - Gender*

In response to the demographic question regarding participants' origin, 86.9% of respondents answered "domestic student," and 11.3% answered "international student" (Figure 4.1.B).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Domestic student**	239	86.9	86.9	86.9
	International student	31	11.3	11.3	98.2
	Not a student	5	1.8	1.8	100.0
	Total	275	100.0	100.0	

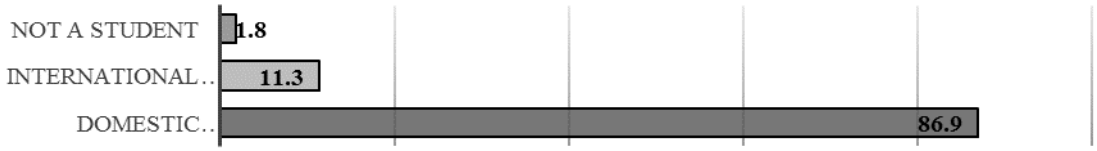


Figure 4.1.B*. Result of demographic question - Domestic, or international background students*

In response to the last demographic question related to their major, 87.6% of respondents answered "Non-design major" and 12.4% answered "Design-related major" (Figure 4.1.C).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Design**	34	12.4	12.4	12.4
	Non-Design	241	87.6	87.6	100.0
	Total	275	100.0	100.0	

Figure 4.1.C. *Result of demographic question - Design related major or non-design major*

Regarding participants' healthcare facility visiting patterns, questions were asked about four topics: first, the type of healthcare facility with which you are familiar and where you have the most experience. Second, the frequency of visits to the facility the participant chose in the first question. Third, average time of a visit. Finally, the purpose of the participant's visit.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Hospital**	155	56.4	56.4	56.4
	Ambulatory care	89	32.4	32.4	88.7
	Residential healthcare	19	6.9	6.9	95.6
	Others	12	4.4	4.4	100.0
	Total	275	100.0	100.0	

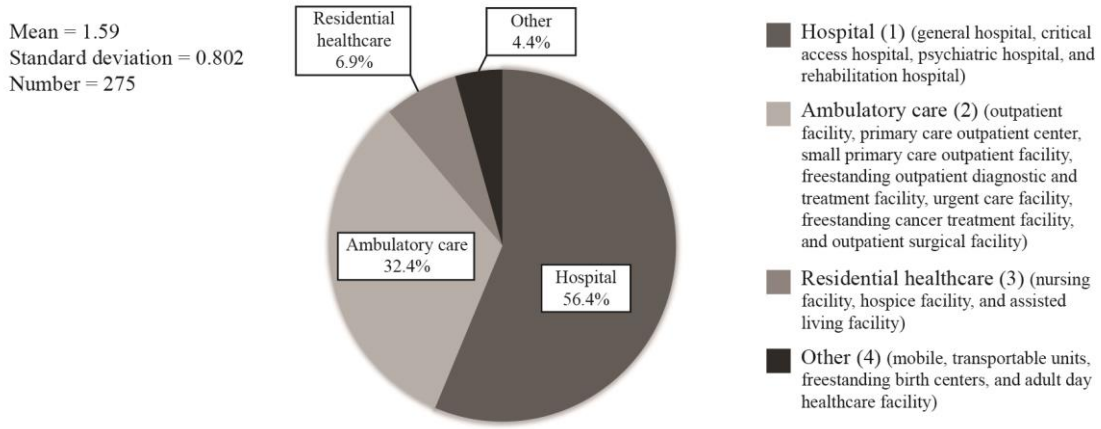


Figure.4.2. A. *Result of visiting pattern question - Type of a healthcare facility*

For the first visiting pattern question (Figure 4.2.A), type of healthcare facility, 56.4% of respondents chose “hospital” (1), including general hospital, critical access hospital, psychiatric hospital, and rehabilitation hospital. 32.4% of respondents answered “ambulatory care” (2) including outpatient facility, primary care outpatient center, small primary care outpatient facility, freestanding outpatient diagnostic and treatment facility, urgent care facility, freestanding cancer treatment facility, and outpatient surgical facility. 6.9% of respondents answered “residential healthcare” (3), including nursing facility, hospice facility, and assisted living facility. 4.4% of respondents answered “other” (4), including mobile, transportable units, freestanding birth centers, and adult day healthcare facility. With respect to the results of a frequency test, the most common response was “hospital.” The mean value of this question was 1.59, and its standard deviation was 0.802.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Less often than once a year**	19	6.9	6.9	6.9
	Once or twice a year	156	56.7	56.7	63.6
	Once in three months	55	20.0	20.0	83.6
	Once a month	18	6.5	6.5	90.2
	Twice a month	12	4.4	4.4	94.5
	Once a week	5	1.8	1.8	96.4
	Twice a week	5	1.8	1.8	98.2
	More than four times a week	3	1.1	1.1	99.3
	Every day/ multiple times a day	2	.7	.7	100.0
	Total	275	100.0	100.0	

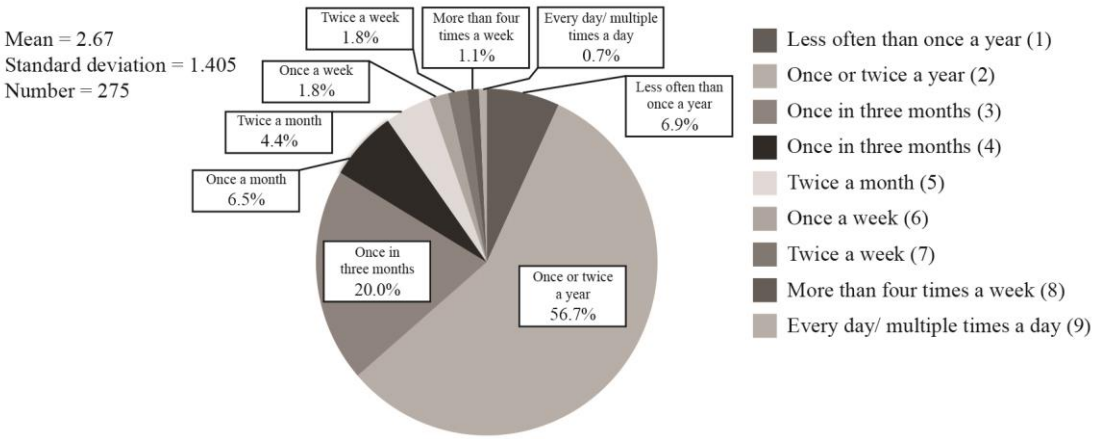


Figure 4.2.B. *Result of visiting pattern question - Frequency of visit*

In response to the second visiting pattern question (Figure 4.2.B) regarding frequency of visit, the most common response was “once or twice a year” with 56.7% of responses, and the second most common response was “once in three months” with 20.0% of responses. The mean value for this question was 2.67, and its standard deviation was 1.405.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**1 ~ 2 hours**	97	35.3	35.3	35.3
	2 ~ 4 hours	121	44.0	44.0	79.3
	4 ~ 6 hours	41	14.9	14.9	94.2
	6 ~ 8 hours	5	1.8	1.8	96.0
	All day	7	2.5	2.5	98.5
	Do not know	2	.7	.7	99.3
	Do not answer	2	.7	.7	100.0
	Total	275	100.0	100.0	

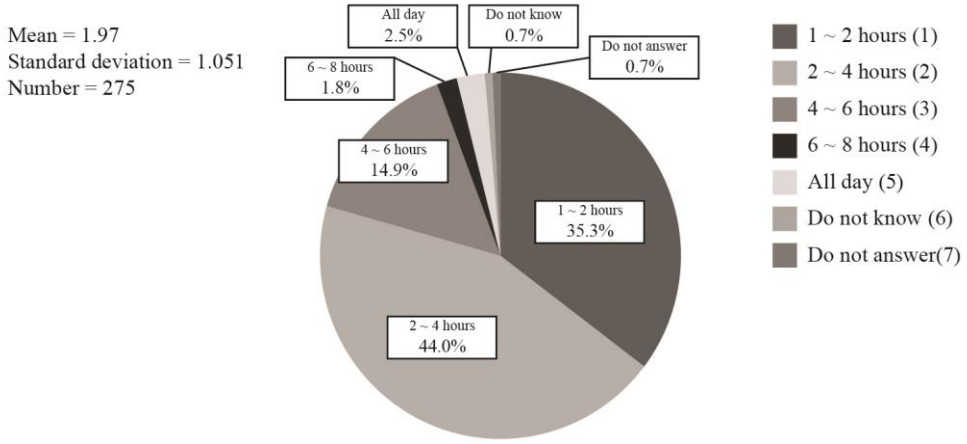


Figure 4.2.C. *Results of visiting pattern questions - Duration of stay*

For the third visiting pattern question (Figure 4.2.C) regarding total duration of stay in the healthcare facility chosen in the first question, the most common response was “2~4 hours” with 44.0% of responses, and the second most common response was “1~2 hours” with 35.3% of responses. The mean value for this question was 1.97, and its standard deviation was 1.051.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**As a patient**	228	82.9	82.9	82.9
	As a visitor	32	11.6	11.6	94.5
	As a volunteer	7	2.5	2.5	97.1
	As a staff	8	2.9	2.9	100.0
	Total	275	100.0	100.0	

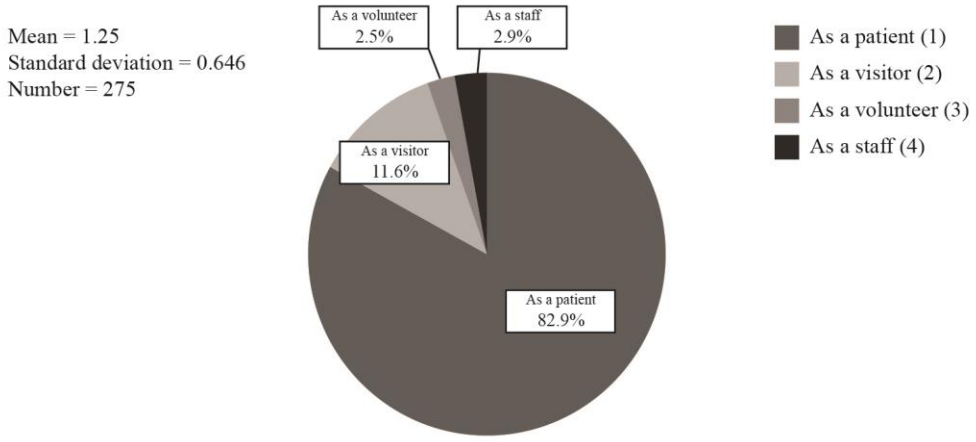


Figure 4.2.D. *Results of visiting pattern questions - Purpose of visit*

For the fourth visiting pattern question (Figure 4.2.D) about purpose of visit, the most common response was "as a patient" with 82.9% of responses. The mean value for this question was 1.25, and its standard deviation was 0.646.

Hypothesis 1 and Survey Analysis

Hypothesis 1: Optimizing positive distraction is the most important wellness design evaluation criteria for the design of the main entry lobby of a healthcare facility.

To test this hypothesis, a descriptive test of the main questions regarding the design features was performed with IBM SPSS. The mean values of each design features' importance, (for example, Q1. A. "How important are the entry experiences of the main entry in the healthcare facility to you?") and mean values of impact on user's wellness, (for example, Q1. B. "What impact do the entrance experience has on your physical well-being,

emotional health, and social interaction?") are used in order to rank the 20 design features and identify their mean values. The below table 4.5, shows the results.

Table 4.5. Mean values of importance of design features, and impacts on physical well-being, emotional health, and social interaction

	Mean value of importance of the design features	Mean value of impacts on physical well-being	Mean value of impacts on emotional health	Mean value of impacts on social interaction
01. entrance experience	3.37	2.64	2.68	2.58
02. entry vestibule experience	3.05	2.66	2.68	2.60
03. basic space program	3.86	2.92	3.00	2.99
04. additional space program	3.41	2.65	2.97	2.93
05. accessibility to other space	2.55	2.49	2.70	2.72
06. nature elements	3.30	2.68	3.24	2.72
07. controlled lighting system	3.15	2.76	2.90	2.47
08. visual appeals	2.84	2.33	2.87	2.51
09. perception of noise	3.09	2.35	2.58	2.50
10. positive sound distractions	2.86	2.52	2.97	2.57
11. air comfort and freshness	3.98	3.26	3.25	2.83
12. environmental support for physical activities	2.70	2.82	2.85	2.67
13. visual and auditory privacy	3.39	2.50	2.96	2.83
14. user controlled environment	2.63	2.62	2.68	2.53
15. information for healthier life	2.83	2.83	2.73	2.53
16. space configuration	3.02	2.55	2.76	2.69
17. variety of furniture	2.85	2.71	2.59	2.72
18. access control system	3.22	2.76	2.79	2.54
19. cleanness and maintenance	3.47	3.42	3.44	3.04
20. infection control	4.28	3.57	3.21	2.84

The responses to the question regarding the importance of design features were answered on a 5-point Likert-type scale (Not at all important (1), Slightly important (2), Moderately important (3), Very important (4), Extremely important (5)). The response to the question regarding the impact on user wellness was answered on a 4-point Likert-type scale (Negative impact (1), No impact (2), Favorable impact (3), Best impact (4)). For example, if the design feature "information for healthier life" had a mean value of 2.83 for the question related to the importance of the design feature, and if a mean value of 2.83 was found for the question on the impact on user's physical well-being, this meant that the level of importance

given to “information for healthier life” was between “moderately important” and “very important,” and the level of importance given to impact on user’s physical well-being of information for healthier life was between “No impact” and “Favorable impact.”

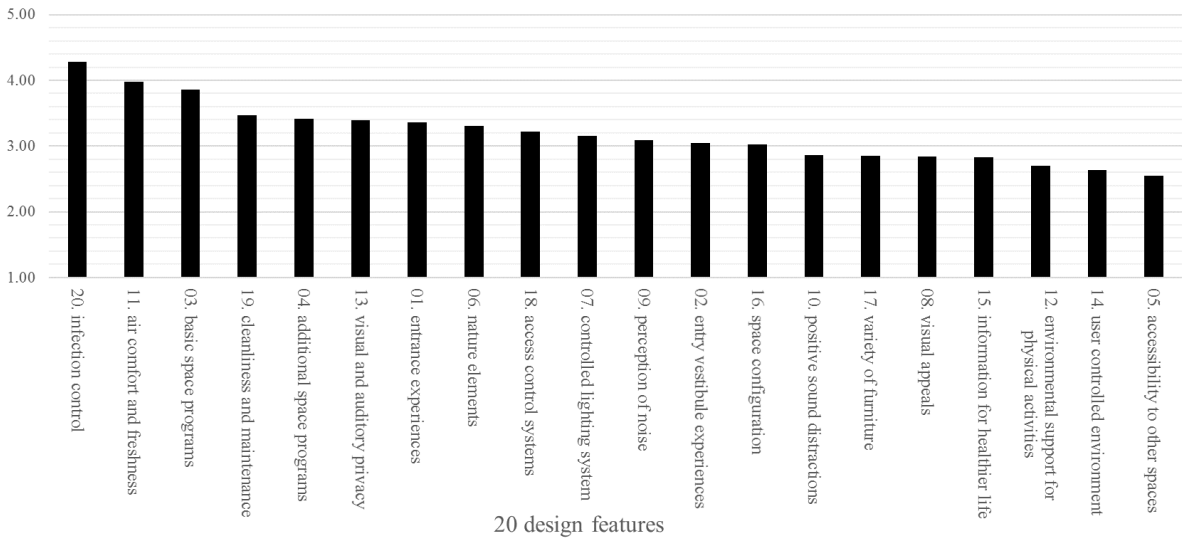


Figure 4.3. *Ranks of design features’ importance (Order higher mean value to lower mean value)*

Figure 4.3 shows that the design feature rated most important was “infection control” (mean value = 4.28). The second most important design feature was “air comfort and freshness” (mean value = 3.98) and the third most important design feature was “basic space program” (mean value = 3.86). In contrast, accessibility to other space, user-controlled space, and environmental support for physical activities were considered the three least important design features in the main entry lobby of a healthcare facility.

As previously indicated in Table 4.4, each design feature was categorized with respect to the five wellness design criteria, and the mean values for the design features were then used to determine the mean values of each wellness design criteria, so as to compare the relative importance of the various wellness design criteria.

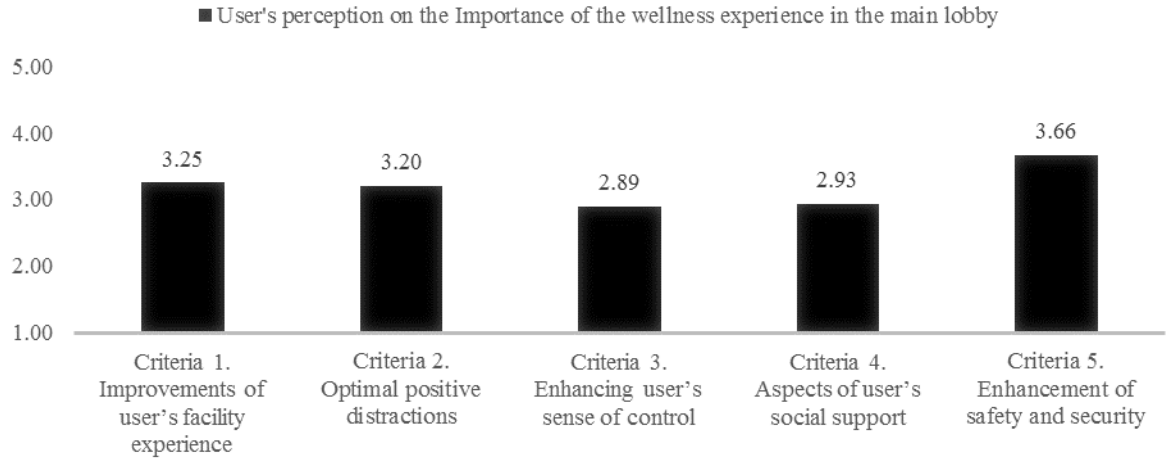


Figure 4.4.A. *Mean value of user's perception on the importance of the wellness design experience which is each mean value of importance of the design features*

Figure 4.4.A shows that wellness criteria 5, enhancement of safety and security, had the highest mean value, 3.66. Second were wellness design criteria 1, improvement of user's facility experience, and criteria 2, optimal positive distraction. The two least important wellness design experience were wellness criteria 3, enhancing user's sense of control, and wellness criteria 4, aspects of social support. However, because the mean values identified the least important wellness criteria, rather than meaning "not at all important (1)," they were still close to meaning "moderately important (3)."

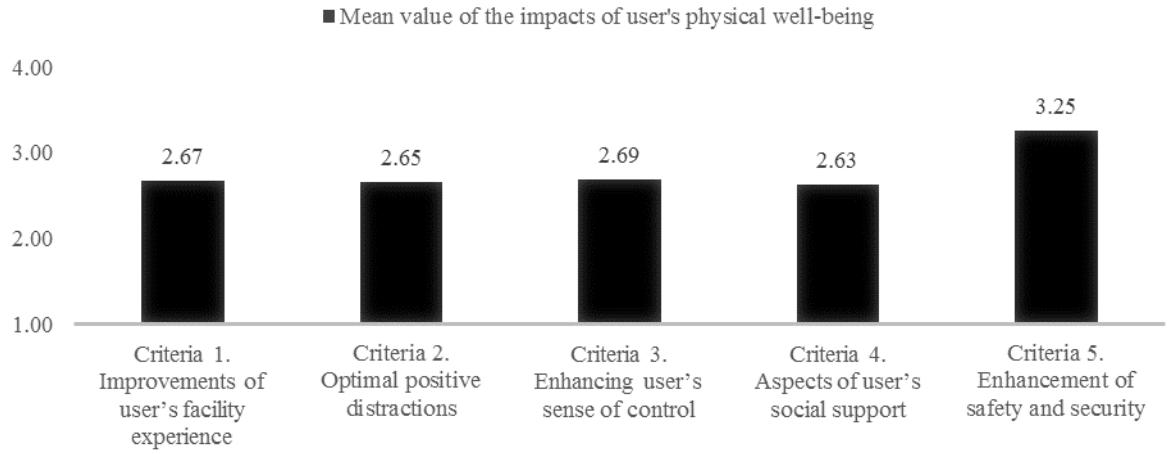


Figure 4.4.B. *Mean values of impacts on user's physical well-being from the design features categorized by wellness design criteria*

Figure 4.4.B presents the mean values of impact on user's physical well-being of the design features categorized by the five wellness design criteria. It is obvious that wellness criteria 1, 2, 3, and 4 had similar mean values, ranging from 2.63 to 2.69, while wellness criteria 5, enhancement of safety and security, had the highest mean value (=3.25), which was located between "Favorable impact" and "Best impact."

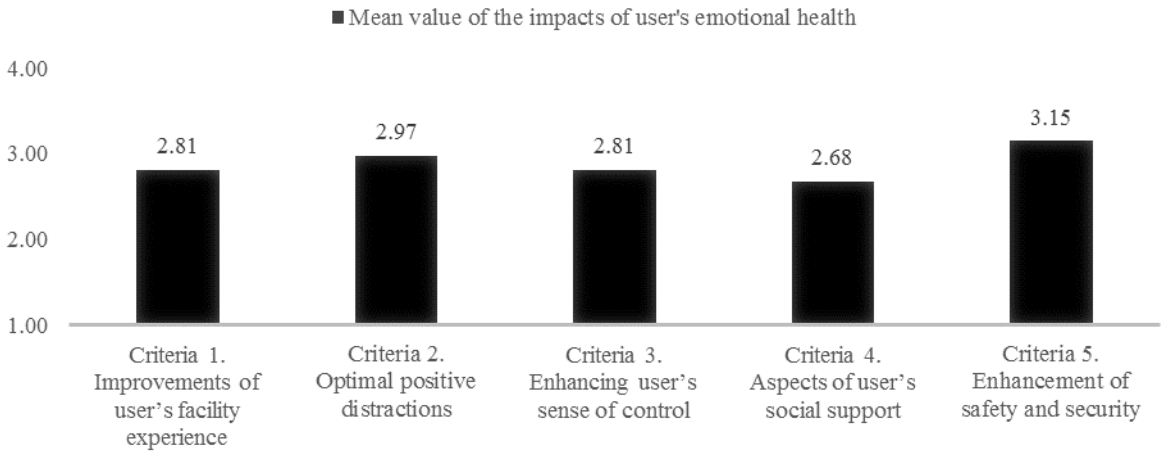


Figure 4.4.C. *Mean values of impacts on user's emotional health from the design features categorized by wellness design criteria*

Figure 4.4.C presents the mean values of impact on user's emotional health of the design features categorized in terms of the five wellness design criteria. The results indicate that wellness evaluation criteria 5, enhancement of safety and security, and wellness evaluation criteria 2, optimal positive distraction, were the top two of the five wellness design criteria.

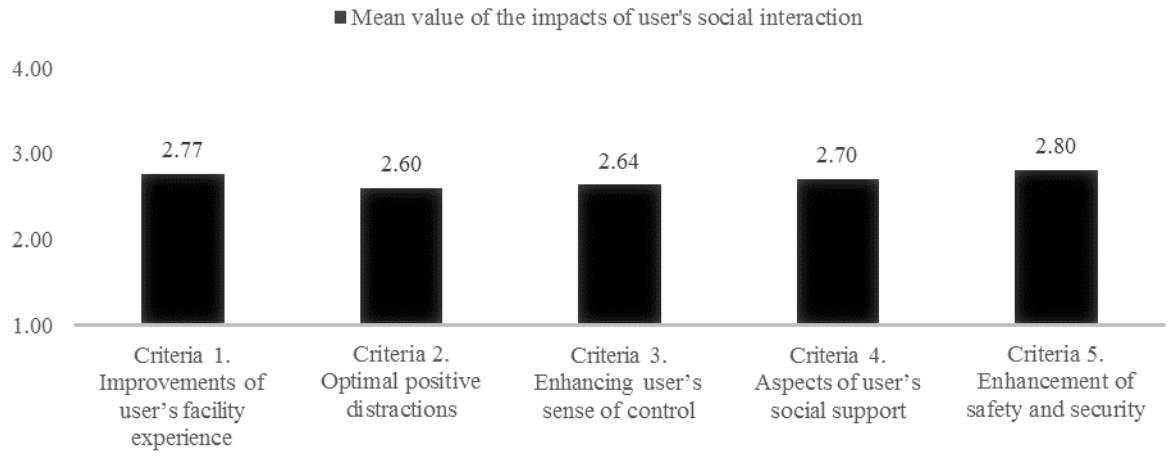


Figure 4.4.D. *Mean values of impacts on user's social interaction from the design features categorized by wellness design criteria*

Figure 4.4.D presents the mean values of impact on user's social interaction of the 20 design features categorized by the five wellness design criteria. There were no obvious differences among the five wellness design criteria, all of which had mean values located between "No impact" (2) and "Favorable impact" (3).

Analysis of the survey data (Figure 4.4.A - 4.4.D) assumed a hypothesis that optimizing positive distractions was the most important criteria in evaluating the main entry lobby of a healthcare facility, but it appears that enhancing safety and security was found to be the most important criteria among the 5 wellness design evaluation criteria. The data reveals which design feature is most important when we design or evaluate a healthcare facility's main lobby and further asks how the data can be utilized in creating wellness design evaluation criteria.

As shown in Table 4.5, users' perception varied for each design feature, and the perceived level of impact on users' wellness also differed. However, existing design evaluation tools do not estimate the different levels of importance of a design feature but merely establish whether or not a design feature is present. It is important to use the survey

data results to set an evaluation standard because it represents an evidence-based design evaluation tool. The ranking of design features shows which design feature is considered the most or the least important with respect to the design of a healthcare facility's main lobby (Figure 4.3). The mean values of the importance of the design features and the impact of the three wellness categories are then utilized as a point of reference for the proposed wellness design evaluation criteria in Chapter six. Whether the mean value is lower or higher than the survey data indicates a user's expectations of the quality of a design feature in the main lobby of a healthcare facility.

Hypothesis 2 and Survey Analysis

Hypothesis 2: There is a high correlation between the importance of design features and their impact on the three types of wellness (physical well-being, emotional health, and social interaction) related to those features.

Pearson's correlation test was used to test hypothesis 2 because Pearson's correlation coefficient is used when one or both variables are in the form of binary variables. Pearson's correlation reflects the degree of linear relationship between two variables (Norries, et al., 2012).

Table 4.6 shows the results of the Pearson's correlations test. For each design feature, the correlation between its importance and its impact on the three types of wellness was statistically significant at a 0.001 probability level. For example, there is a significant positive relationship between user's entrance experience and its impact on physical well-being ($r = 0.583$, $p < 0.001$), emotional health ($r = 0.570$, $p < 0.001$), and social interaction ($r = 0.543$, $p < 0.001$).

Table 4.6. Result of Pearson's correlation tests of between importance of the design features and the three types of wellness (physical well-being, emotional health, and social interaction)

				Importance of the feature	Impact on		
					physical well-being	emotional health	social interaction
Improvement of user's experience	Entrance experience	Importance of the feature	Pearson Correlation	1	.583**	.570**	.543**
			Sig. (2-tailed)		0	0	0
	Entry vestibule experience	Importance of the feature	Pearson Correlation	1	.572**	.521**	.461**
			Sig. (2-tailed)		0	0	0
	Basic space program	Importance of the feature	Pearson Correlation	1	.467**	.503**	.476**
			Sig. (2-tailed)		0	0	0
	Accessibility to other space	Importance of the feature	Pearson Correlation	1	.498**	.579**	.526**
			Sig. (2-tailed)		0	0	0
	Additional space program	Importance of the feature	Pearson Correlation	1	.423**	.540**	.529**
			Sig. (2-tailed)		0	0	0
Optimal positive distraction	Nature elements	Importance of the feature	Pearson Correlation	1	.549**	.607**	.468**
			Sig. (2-tailed)		0	0	0
	Controlled lighting system	Importance of the feature	Pearson Correlation	1	.494**	.556**	.413**
			Sig. (2-tailed)		0	0	0
	Visual appeals	Importance of the feature	Pearson Correlation	1	.473**	.694**	.498**
			Sig. (2-tailed)		0	0	0
	Perception of noise	Importance of the feature	Pearson Correlation	1	.347**	.382**	.323**
			Sig. (2-tailed)		0	0	0
	Positive sound distractions	Importance of the feature	Pearson Correlation	1	.505**	.638**	.548**
			Sig. (2-tailed)		0	0	0
	Air comfort and freshness	Importance of the feature	Pearson Correlation	1	.604**	.556**	.359**
			Sig. (2-tailed)		0	0	0
Enhancing user's sense of control	Support for physical activities	Importance of the feature	Pearson Correlation	1	.566**	.579**	.530**
			Sig. (2-tailed)		0	0	0
	Visual and auditory privacy	Importance of the feature	Pearson Correlation	1	.392**	.601**	.548**
			Sig. (2-tailed)		0	0	0
	User controlled environments	Importance of the feature	Pearson Correlation	1	.611**	.623**	.578**
			Sig. (2-tailed)		0	0	0
	Information for healthier life	Importance of the feature	Pearson Correlation	1	.666**	.692**	.617**
			Sig. (2-tailed)		0	0	0
Aspects of social support	Space configuration	Importance of the feature	Pearson Correlation	1	.583**	.570**	.543**
			Sig. (2-tailed)		0	0	0
	Variety of furniture	Importance of the feature	Pearson Correlation	1	.524**	.548**	.530**
			Sig. (2-tailed)		0	0	0
Enhancement of safety and security	Access control system	Importance of the feature	Pearson Correlation	1	.584**	.591**	.472**
			Sig. (2-tailed)		0	0	0
	Cleanness and maintenance	Importance of the feature	Pearson Correlation	1	.499**	.523**	.347**
			Sig. (2-tailed)		0	0	0
	Infection control system	Importance of the feature	Pearson Correlation	1	.558**	.548**	.393**
			Sig. (2-tailed)		0	0	0

Note: **. Correlation is significant at the 0.01 level (2-tailed). N=275

Analysis of the survey data in Table 4.6 indicates that hypothesis 2 is supported. For example, participants who considered the entrance experience as highly important to their visiting experience also considered it to have a high impact on their physical, emotional, and social wellbeing. This obviously supports the idea that a visiting design feature that meets

high expectations of users would provide a positive impact on user's physical well-being, emotional health, and social interaction.

Hypothesis 3 and Survey Analysis

Hypothesis 3: User experience will vary across users' visiting patterns (type of facility, frequency of visit, duration of visit, and purpose of visit) depending on design features in a healthcare main entry lobby.

To test this hypothesis, a one-way analysis of variance (ANOVA) with IBM SPSS was performed for statistical significance. A one-way ANOVA "can be used when the means of three or more groups are to be compared" (Norris, et al., 2012 P204). Four different user visiting patterns were examined based on the types of healthcare facility, the frequencies of healthcare facility visit, duration of visits, and purpose of visits to the selected healthcare facility.

Table 4.7.A. Results of ANOVA – Type of facility

	Sum of Squares	df	Mean Square	F	Sig.
Entry vestibule experience impacts on emotional health	3.675	3	1.225	2.647	0.049*
Access control system impacts on physical well-being	5.122	3	1.707	3.506	0.016*
Accessibility to other space impacts on emotional health	4.738	3	1.579	3.083	0.028*
Nature elements impact on emotional health	4.197	3	1.399	2.820	0.039*
Controlled lighting system impacts on physical well-being	6.538	3	2.179	4.594	0.004*
Information for healthier life impact on physical well-being	5.549	3	1.850	3.683	0.013*
Information for healthier life impact on emotional health	6.349	3	2.116	3.556	0.015*
Information for healthier life impact on social interaction	4.200	3	1.400	2.782	0.041*

Note: *· ANOVA is significant at the 0.05 level. N=275
Modified from ANOVA – Frequency of visit

The researcher attempted to identify the impact of the four different types of healthcare facility (hospital, ambulatory care, residential healthcare, and others) on respondents' physical well-being, emotional health, and social interaction with regard to evaluating the main entry lobby of a healthcare facility.

Table 4.7.A shows the summarized results of ANOVA representing the only results for which the the p value was 0.05 or less. Statistical significance indicates a significant difference among the four types of healthcare facility. Among 20 design features, three showed a significance difference (access control system, controlled lighting system, and information for healthier life) depending on the types of healthcare facility visited and how much impact this made on respondents' physical well-being. The other four design features (entry vestibule experience, accessibility to other space, nature elements, and information for healthier life) showed significant differences among the four types of healthcare facility in terms of the impact on respondents' emotional health. One design feature (information for healthier life) displayed a significant difference among the four types of healthcare facility with regard to its impact on respondents' social interaction.

Table 4.7.B. Results of ANOVA - Frequency of visit

	Sum of Squares	df	Mean Square	F	Sig.
Entry vestibule experience impacts on emotional health	8.200	8	1.025	2.255	0.024*

Note: *· ANOVA is significant at the 0.05 level. N=275
Modified from ANOVA – Frequency of visit

The researcher attempted to determine the impact of the nine different frequencies of respondents' healthcare facility visits (less often than once a year, once or twice a year, once in three months, once a month, twice a month, once a week, twice a week, more than four times a week, every day/ multiple times a day) on physical well-being, emotional health, and social interaction based on experience in the main entry lobby.

Table 4.7.B shows that one design feature (entry vestibule experience) exhibited significant differences among the four types of healthcare facility in terms of the impact on respondents' emotional health.

Table 4.7.C. Results of ANOVA - Duration of Stay

	Sum of Squares	df	Mean Square	F	Sig.
Entry vestibule experience impacts on physical well-being	7.545	6	1.258	2.647	0.016*
Entry vestibule experience impacts on emotional health	6.070	6	1.012	2.204	0.043*
Access control system impacts on physical well-being	15.171	6	2.529	5.558	0.000*
Basic space program impacts on social interaction	7.901	6	1.317	2.799	0.012*
Accessibility to other space impacts on emotional health	6.886	6	1.148	2.251	0.039*

Note: *, ANOVA is significant at the 0.05 level. N=275
Modified from ANOVA – Duration of Stay

The researcher attempted to determine the impact of the seven different durations of respondents' healthcare facility visits (1~2 hours, 2~4 hours, 4~6 hours, 6~8 hours, all day, do not know, do not answer) on physical well-being, emotional health, and social interaction in the main entry lobby.

Table 4.7.C shows that two design features (entry vestibule experience, and access control system) were significantly different among the four types of healthcare facilities with regard to impact on respondents' physical well-being. Two design features (entry vestibule experience, and accessibility to other space) differed significantly among the four types of facility with regard to impact on respondents' emotional health. One design feature (basic space program) differed significantly among the four types of facility with regard to impact on respondents' social interaction.

Table 4.7.D. Results of ANOVA - Purpose of visit

	Sum of Squares	df	Mean Square	F	Sig.
Entry vestibule experience impacts on emotional health	5.531	3	1.844	4.043	0.008*
Access control system impacts on physical well-being	4.477	3	1.492	3.049	0.029*
Environmental support for physical activities impact on physical well-being	5.588	3	1.863	3.489	0.016*
Environmental support for physical activities impact on emotional health	5.277	3	1.759	3.353	0.019*
Variety of furniture impact on physical well-being	5.321	3	1.774	3.509	0.016*
Nature elements impact on physical well-being	7.952	3	2.651	4.869	0.003*
Visual appeals impact on emotional health	3.666	3	1.222	2.641	0.050*
Positive sound distractions impact on physical well-being	4.029	3	1.343	2.969	0.032*
Information for healthier life impact on emotional health	6.142	3	2.047	3.436	0.017*

Note: *, ANOVA is significant at the 0.05 level. N=275
Modified from ANOVA –Purpose of visit

The researcher attempted to determine the impact of the four different purposes of respondents' healthcare facility visit (as a patient, as a visitor, as a volunteer, or as a staff) on physical well-being, emotional health, and social interaction.

As seen in Table 4.7.D, five design features (access control system, environmental support for physical activities, variety of furniture, nature elements, and positive sound distractions) showed significant differences among the four types of healthcare facility with respect to impact on respondents' physical well-being. Four design features (entry vestibule experience, environmental support for physical activities, visual appeals, and information for healthier life) showed significant differences among the four types of healthcare facility in their impact on respondents' emotional health.

Analysis of the survey data showed support for hypothesis 3. Five design features showed significant differences with respect to responses to questions related to type of facility, and eight design features showed significant differences in responses to questions regarding the purpose of the visit. The results of ANOVA indicate that at least one design feature, the impact on user's wellness, differed significantly. These results imply that, whether the lobby design supports users' expectations or not, it would be different depending on the type of healthcare facility, frequency of respondent's visit, duration of respondent's visit, and purpose of respondent's visit when designing wellness design evaluation criteria. In particular, it is suggested that different wellness design evaluation criteria are needed for different types of healthcare facility for different user groups.

It is, however, reasonable to cover all users regardless of their visiting pattern. The researcher argues that these results do not mean that the basis of the assessment must differ among visiting patterns, because only one design feature, information for healthier life, had

significant impact on all three types of wellness. On the other hand, designing facility design evaluation tools for different types of healthcare facilities or different user groups is suggested for highly detailed evaluations.

Hypothesis 4 and Survey Analysis

Hypothesis 4: User experience will vary across user's demographic differences (male vs. female, design vs. non-design major, and domestic vs. international background) depending on the design features in a healthcare main entry lobby.

To test hypothesis 4, an independent unrelated t-test with IBM SPSS was performed to identify the statistical significance of respondents' demographics. Such an unrelated t-test can be used when the means of two distinct groups of respondents are to be compared with regard to different sets of variables (Norris et al., 2012). Three demographic differences (male vs. female, design vs. non-design major, and domestic vs. international background) were examined.

Table 4.8.A. Results of t-test – Male vs. Female

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Basic space program impacts on physical well-being	11.464	0.001*	-0.901	273	0.369	-0.078	0.087	-0.248	0.093
Visual appeals impact on physical well-being	4.006	0.046*	-1.429	273	0.154	-0.103	0.072	-0.245	0.039

Note: *. T-test is significant at the 0.05 level. N=275

Modified from t-test – Male vs. Female

The researcher first attempted to identify the effect of gender difference on respondents' experience of physical well-being, emotional health, and social interaction with regard to evaluating the main entry lobby of a healthcare facility.

Table 4.8.A shows the summarized results, displaying only the categories with statistical significance at a level of 0.05 or less that indicates a statistically significant differences between males and females. Two design features (basic space program, and visual appeals) among 20 design features differed significantly between males and females in their impact on respondents' physical well-being.

Table 4.8.B. Results of t-test – Design major vs. Non-design major

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Variety of furniture impact on emotional health	10.773	0.001*	1.574	273	0.117	0.192	0.122	-0.048	0.432
Controlled lighting system impacts on physical well-being	4.038	0.045*	1.546	273	0.123	0.198	0.128	-0.054	0.451
Visual and auditory privacy impact on social interaction	5.300	0.022*	1.030	273	0.304	0.157	0.153	-0.143	0.458
Infection control system impact on physical well-being	21.488	0.000*	2.426	273	0.016	0.288	0.119	0.054	0.522

Note: *. T-test is significant at the 0.05 level. N=275

Modified from t-test – Design major vs. Non-design major

The researcher next attempted to determine the impact of a user's design background on the experience of physical well-being, emotional health, and social interaction with regard to evaluation of the main entry lobby of a healthcare facility.

Table 4.8.B, shows summarized results of the t-test. It displays only the categories with statistical significance at a level of 0.05 or less that indicated a significant difference between respondents in design-related majors and respondents not in design-related majors. Two design features (controlled lighting system and infection control system) among 20 design features exhibited a significant difference between the two groups with regard to impact on respondents' physical well-being. One design feature (variety of furniture) exhibited a significant difference between the two groups with regard to impact on

respondents' emotional health. One design feature (visual and auditory privacy) differed significantly between the two groups with regard to impact on respondents' experience of social interaction.

Table 4.8.C. Results of t-test – Domestic background vs. International background

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Entry vestibule experience impacts on emotional health	7.836	0.005*	-3.366	268	0.001	-0.429	0.127	-0.679	-0.178
Entry vestibule experience impacts on social interaction	12.103	0.001*	-3.485	268	0.001	-0.439	0.126	-0.688	-0.191
Access control system impacts on emotional health	5.015	0.026*	-1.853	268	0.065	-0.254	0.137	-0.524	0.016
Accessibility to other space impact on emotional health	8.596	0.004*	-2.234	268	0.026	-0.307	0.137	-0.577	-0.036
Environmental support for physical activities impact on emotional health	7.486	0.007*	-0.916	268	0.361	-0.127	0.138	-0.399	0.146
Visual appeals impact on physical well-being	12.127	0.001*	-1.068	268	0.287	-0.121	0.113	-0.344	0.102
Visual appeals impact on emotional health	6.911	0.009*	0.676	268	0.499	0.089	0.132	-0.170	0.348
Visual appeals impact on social interaction	4.872	0.028*	-1.360	268	0.175	-0.171	0.126	-0.419	0.077
Perception of noise impact on physical well-being	9.109	0.003*	-2.315	268	0.021	-0.327	0.141	-0.605	-0.049
Cleanness and maintenance impact on physical well-being	4.848	0.029*	0.405	268	0.686	0.052	0.129	-0.202	0.306

Note: *. T-test is significant at the 0.05 level. N=275
Modified from t-test – domestic vs. international background

Table 4.8.C shows summarized results of t-tests, displaying only the categories with the statistical significance as shown by a p value of 0.05 or less. Significant differences were found between respondents who grew up in the U.S. and respondents who grew up outside of the U.S. the age of 18 years. Three design features (visual appeals, perception of noise, and cleanness and maintenance) of 20 design features were significantly different between the two groups with respect to the impact of those features on respondents' physical well-being. Five design features (entry vestibule experience, access control system, accessibility to other

space, environmental supports for physical activities, and visual appeals) exhibited significant differences between the two groups with regard to impact on respondents' emotional health. Two design features (entry vestibule experience, and visual appeals) exhibited significant differences between the two groups with regard to impact on respondents' experience of social interaction in the main lobby.

Analysis of the survey data supports hypothesis 4. The results of the unrelated t-tests show that the impact of at least one design feature on user's wellness differed significantly among the demographic groups. This result indicates that different demographic groups, specifically with regard to gender, design-related or non-design-related major, and those with domestic or international background, perceive some design features differently in terms of the effects of these features on their wellness. While it would be possible to create and develop different wellness design evaluation tools for different user groups, it is assumed that this result would have little impact on the assessment of the results for this research.

Summary of the Result

In this study, both content analysis and an online survey were conducted to answer the research questions. Information required for creating wellness design evaluation criteria was collected from the six existing evaluation tools and design guidelines. Research information was organized based on the five wellness design criteria newly developed from the literature review, accompanied by 20 design features identified through content analysis.

The online survey investigated the criteria through which users perceived the design features in their experiences during the previous 12 months with respect to a healthcare facility's main entry lobby. Four important findings emerged from the results of the survey.

First, the results of the online survey showed that the respondents had different perceptions with respect to the importance of design features. “Enhancement of safety and security” was perceived as the most important of the 5 wellness design criteria, and “improvement of the user’s facility experience” was the second most important consideration. Second, the data revealed the mean values of the impact of various features on respondents’ three types of wellness experience. These average values can serve as useful criteria for assessing effectiveness of a healthcare facility’s main entry lobby. Third, importance of a design feature and its impact on respondents’ three types of wellness experience were correlated so that they could be used as the basis of a formula for an itemized score of a particular design feature, as discussed in Chapter 6. Finally, the analysis of hypotheses 3 and 4 showed that some design features exhibited significant differences in terms of responses to visiting pattern questions and demographic questions. However, it is assumed that this data would have little impact on the assessment of the results of this research study.

CHAPTER V

DEVELOPMENT OF A DESIGN EVALUATION TOOL

Wellness Design Evaluation Tool for the Design of Main Entry Lobby of a Healthcare Facility

In this chapter, a wellness design evaluation tool for the main entry lobby of a healthcare facility will be introduced. The tool is developed for use in designing a main entry lobby or attempting to improve users' experience at a healthcare facility. Details of the criteria were created from the literature review and analysis of the six evaluation standards and guidelines listed previously in Chapter 2.

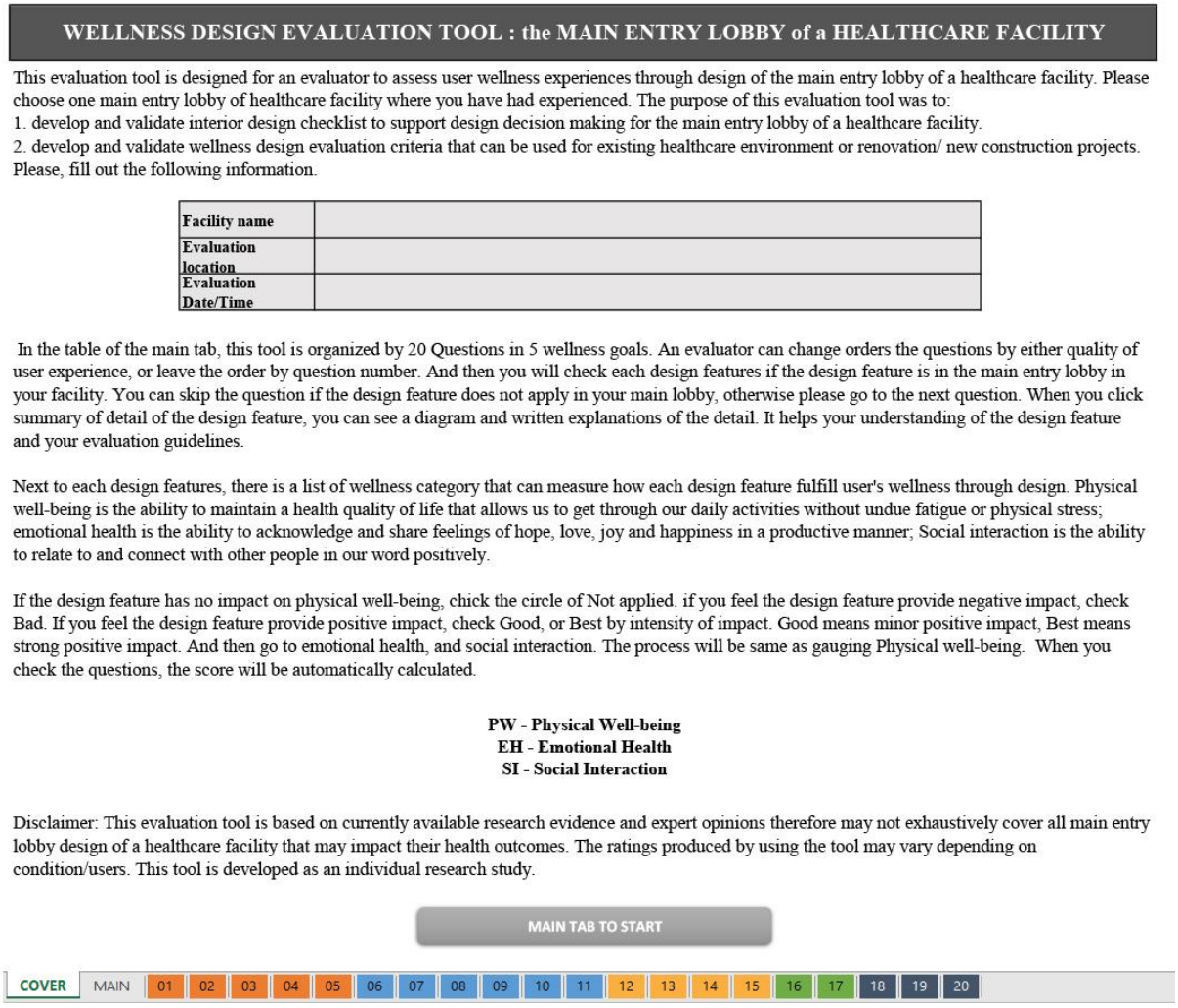
Based on the evaluation criteria, the tool is designed into two parts. The first part is a Microsoft Excel format that formulates percentile ranks based on the sum of itemized raw evaluation scores. The second part of the tool consists of diagrams of the twenty design features with a supplementary explanation based on Table 4.3.A – E, and Table 4.4, as well as a section (quality of user's experiences in a healthcare main lobby) of the literature review.

Wellness Design Evaluation Tool

Figure 5.1 presents the proposed tool for evaluating the design of a healthcare main lobby, it can be downloaded by a prospective user.

An evaluator must open this tool using an upgraded version of Microsoft Excel 2016 because the tool includes macros for calculating a percentile score to be used in evaluating the level of quality an evaluator experienced. Alternatively, the evaluator can print the tool

on an 8½" x 11" paper for convenient use at a site where an evaluation is to be conducted, the evaluator then can input the data using Microsoft Excel.



WELLNESS DESIGN EVALUATION TOOL : the MAIN ENTRY LOBBY of a HEALTHCARE FACILITY

This evaluation tool is designed for an evaluator to assess user wellness experiences through design of the main entry lobby of a healthcare facility. Please choose one main entry lobby of healthcare facility where you have had experienced. The purpose of this evaluation tool was to:
1. develop and validate interior design checklist to support design decision making for the main entry lobby of a healthcare facility.
2. develop and validate wellness design evaluation criteria that can be used for existing healthcare environment or renovation/ new construction projects.
Please, fill out the following information.

Facility name	
Evaluation location	
Evaluation Date/Time	

In the table of the main tab, this tool is organized by 20 Questions in 5 wellness goals. An evaluator can change orders the questions by either quality of user experience, or leave the order by question number. And then you will check each design features if the design feature is in the main entry lobby in your facility. You can skip the question if the design feature does not apply in your main lobby, otherwise please go to the next question. When you click summary of detail of the design feature, you can see a diagram and written explanations of the detail. It helps your understanding of the design feature and your evaluation guidelines.

Next to each design features, there is a list of wellness category that can measure how each design feature fulfill user's wellness through design. Physical well-being is the ability to maintain a health quality of life that allows us to get through our daily activities without undue fatigue or physical stress; emotional health is the ability to acknowledge and share feelings of hope, love, joy and happiness in a productive manner; Social interaction is the ability to relate to and connect with other people in our word positively.

If the design feature has no impact on physical well-being, chick the circle of Not applied. if you feel the design feature provide negative impact, check Bad. If you feel the design feature provide positive impact, check Good, or Best by intensity of impact. Good means minor positive impact, Best means strong positive impact. And then go to emotional health, and social interaction. The process will be same as gauging Physical well-being. When you check the questions, the score will be automatically calculated.

PW - Physical Well-being
EH - Emotional Health
SI - Social Interaction

Disclaimer: This evaluation tool is based on currently available research evidence and expert opinions therefore may not exhaustively cover all main entry lobby design of a healthcare facility that may impact their health outcomes. The ratings produced by using the tool may vary depending on condition/users. This tool is developed as an individual research study.

MAIN TAB TO START

COVER MAIN 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

Figure 5.1. *Final template of a wellness design evaluation tool for the main entry lobby of a healthcare facility - an instruction of the wellness design evaluation tool, the first tab, called a cover tab*

The instruction section describes how to use the tool and how the evaluation should be processed (Figure 5.1). An evaluator should carefully read the instructions at the top of the tool before initiating an evaluation.

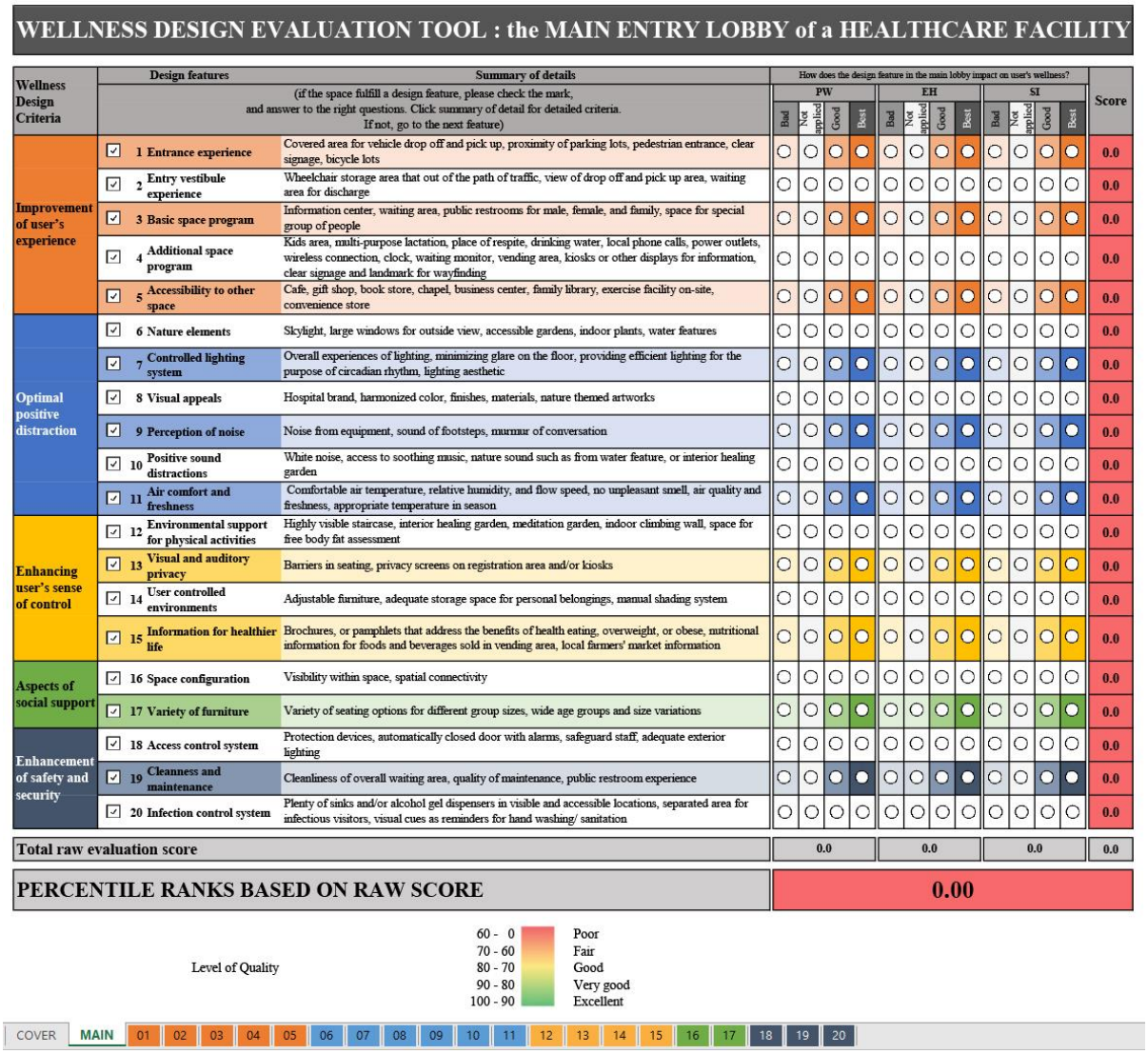


Figure 5.2. *Final template of a wellness design evaluation tool for the main entry lobby of a healthcare facility, showing a main tab with wellness design evaluation criteria and scoring parts*

The second part of the tool is displayed on the main tab (Figure 5.2). It displays wellness design criteria with design features and narratives that would have potential impact on users' physical well-being, emotional health, and social interaction in the main lobby. Itemized scores are listed for each design feature and its criteria, as well as a total score based on percentile ranks. As explained in the instructions, an evaluator should spend at least a half hour in the main entry lobby of the chosen healthcare facility. The main entry lobby could be

assessed at any time, but the entire process should be performed within a period of 12 months, the same length required for the survey. The researcher believes that the assessment would be best if performed at the same time and the same location at which the evaluator has experience. An evaluator would read each design feature and its details and then check whether each design feature is to be found in the main entry lobby. The evaluator would then check the three types of wellness aspects in terms of user experience: 1) physical well-being (the ability to maintain a healthy quality of life that allows us to get through our daily activities without undue fatigue or physical stress), 2) emotional health (the ability to acknowledge and share feelings of hope, love, joy and happiness in a productive manner), and 3) social interaction (the ability to relate to and positively connect with other people in our world). If a design feature seems to have no impact on physical well-being, the evaluator would check the circle indicating "Not Applied". If an evaluator feels that a design feature provides a negative impact, 'Bad' would be checked. If an evaluator feels that a design feature provides a positive impact, "Good", or "Best" would be checked. "Good" means minor positive impact while "Best" means strong positive impact. The process of evaluating impact on emotional health and social interaction will be the same as for gauging Physical Well-being. When an evaluator responds to a questions the score will be automatically calculated.

Importance of a design feature X (Value of **Physical well-being** + Value of **Emotional Health** + Value of **Social Interaction**) = An **itemized score** of a design feature

Figure 5.3. *A formula of an Itemized score*

An itemized score is the result of a formula (Figure 5.3) producing a sum of the three types of wellness, multiplied by the importance of a design feature on a scale of one to four. This formula represents a reasonable way for presenting the correlation between importance of a design feature and its impact on one's wellness. In a case where two design features have same level of impact on one's wellness, a design feature with higher importance would receive a higher itemized score than the design feature with lower importance. The scores are color-coded r to make them easy to compare with the results of itemized scores from the online survey (Table 5.1).

Table 5.1. Results of itemized scores from the online survey

	Mean value of importance of the design features	Mean value of impacts on physical well-being	Mean value of impacts on emotional health	Mean value of impacts on social interaction	Itemized scores of design features
01. entrance experience	3.37	2.64	2.68	2.58	**26.6**
02. entry vestibule experience	3.05	2.66	2.68	2.60	**24.2**
03. basic space program	3.86	2.92	3.00	2.99	**34.4**
04. additional space program	3.41	2.65	2.97	2.93	**29.2**
05. accessibility to other space	2.55	2.49	2.70	2.72	**20.2**
06. nature elements	3.30	2.68	3.24	2.72	**28.5**
07. controlled lighting system	3.15	2.76	2.90	2.47	**25.7**
08. visual appeals	2.84	2.33	2.87	2.51	**21.9**
09. perception of noise	3.09	2.35	2.58	2.50	**23.0**
10. positive sound distractions	2.86	2.52	2.97	2.57	**23.1**
11. air comfort and freshness	3.98	3.26	3.25	2.83	**37.2**
12. environmental support for physical activities	2.70	2.82	2.85	2.67	**22.5**
13. visual and auditory privacy	3.39	2.50	2.96	2.83	**28.1**
14. user controlled environment	2.63	2.62	2.68	2.53	**20.6**
15. information for healthier life	2.83	2.83	2.73	2.53	**22.9**
16. space configuration	3.02	2.55	2.76	2.69	**24.2**
17. variety of furniture	2.85	2.71	2.59	2.72	**22.8**
18. access control system	3.22	2.76	2.79	2.54	**26.1**
19. cleanness and maintenance	3.47	3.42	3.44	3.04	**34.4**
20. infection control	4.28	3.57	3.21	2.84	**41.2**

Figure 5.4 shows the color-coding system of the itemized scores. Green indicates that an itemized score of a design feature is greater than the survey itemized score that represents user's mean of expectations. Yellow indicates that an itemized score of a design feature is the

same as the survey result. Red indicates a value below the user's mean of expectations. These color-coded scores could indicate whether or not the design feature satisfies a user's expectations.

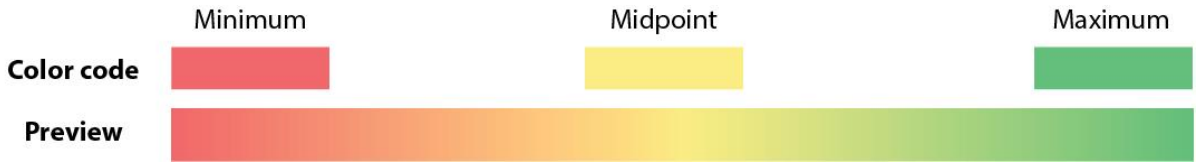


Figure 5.4. *Color coding system of an itemized score of a design feature*

For example, if an evaluator assessing "Entrance experience" checked "Good" on physical well-being, checked "Not applied" on emotional health, and checked "Best" on social interaction, the itemized score would be 30.3, which would be displayed as a yellowish green color in the score cell. The score with respect to entrance experience is formulated so that the importance of entrance experience, 3.37, multiplies a sum of the value of "Good," 3, for physical well-being, the value of "Not applied," 2, for emotional health, and the value of "Best," 4, for social interaction. The yellowish green color means that the itemized score of entrance experience, 30.3, is above the mean value of a score from the survey results (Table 5.1), 26.6, the value for importance of entrance experience, 3.37, the multiplied sum of the mean value of physical well-being from the survey results, 2.64, the mean value for emotional health from the survey results, 2.68, and the mean value of social interaction from the survey results, 2.58.

The total raw evaluation score represents the sum of the itemized scores of 20 design features. In the bottom row of total raw evaluation scores, there are also sums of each type of

wellness aspects in three parts (Figure 5.2). An evaluator can analyze the type of wellness aspect emphasized in the design of a main entry lobby by comparing the three scores.

$$\sum \text{Itemized scores of 20 design features} \;/\; \sum \underset{(766.3)}{\text{Maxium itemized scores of 20 design features}} \times 100 = \textbf{Percentile ranks based on raw score}$$

Figure 5.5. *A formula of percentile ranks based on raw score*

Percentile ranks based on raw score are modified scores for analyzing the total raw evaluation score when compared to the mean values of the survey result (Figure 5.5). They represent an average value of individuals' perceptions of their healthcare facility experience. The maximum total raw evaluation score would be 766.3 if an evaluator checks "Best" in all aspects. The total raw evaluation score of the survey result would be 574.7 of an evaluator checks "Good" on all aspects. If an evaluator checks "Not applied" on all aspects, the total raw evaluation score would be 383.2, while the minimum total raw evaluation score would be 191.6 if an evaluator checks "Bad" on all aspects. Using the formula above, the total raw evaluation score should be divided by the maximum total raw evaluation score, 766.3, to allow results to be automatically calculated.

The researcher hypothesizes that if the evaluation results in scores are greater than 90 in all percentile ranks, the quality of design regarding the user's wellness experience is at the "excellent" level. Evaluation results fpr a score lie between 80 to 90 in percentile ranks would represent a "very good" level of quality. A score between 70 to 80 in percentile ranks would correspond to a "good" level of quality because the percentile ranks of the survey results were 70. A score ranging between 70 to 60 of percentile ranks would represent a

"fair" level of quality, and a score below 60 of percentile ranks would represent a "poor" level of quality.

Wellness Design Evaluation Tool: A Reference Guide

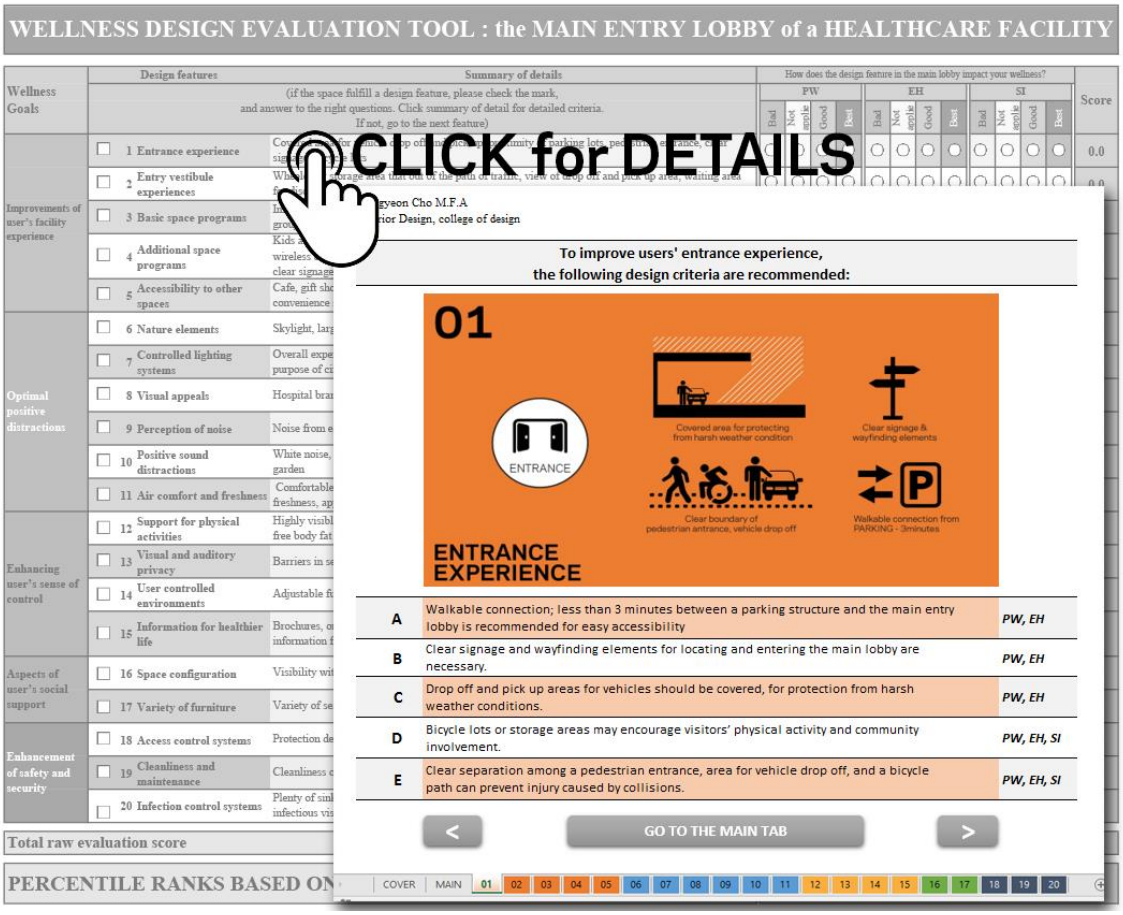
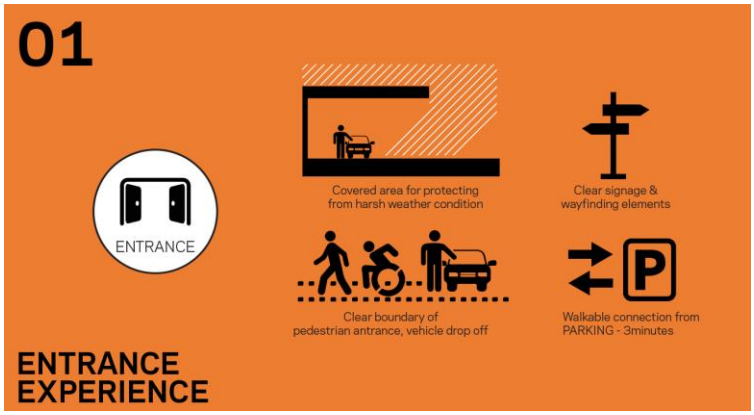


Figure 5.6. *Detail of wellness design evaluation tool and a reference guide for users*

An evaluator can check design feature details by either clicking the summary of detail of the design feature or by clicking on tabs related to information an evaluator wants to know in more detail. Details of each design feature on each sheet are accompanied by a combination of diagrams with written explanations. Each sheet also contains a column of information that helps an evaluator understand how each criterion is related to a wellness type, e.g., PW, EH, and SI. PW represents Physical Well-being, EH represents Emotional

Health, and SI represents Social Interaction. An evaluator can use this information as an assessment aid. An evaluator can navigate easily to a next criteria of a design feature, to a previous criteria of a design feature, or to the main menu either by using the arrow buttons or clicking the tabs at the bottom. 20 design feature tabs are color-coded to indicate which feature is related to which wellness design criteria. Orange color-coded tabs represent "improvement of user's experience", blue-coded tabs represent "optimal positive distraction", yellow-coded tabs represent "enhancing user's sense of control", green-coded tabs represent "aspects of social support", and navy-coded tabs represent "enhancement of safety and security".

To improve users' entrance experience, the following design criteria are recommended:		
		
A	Walkable connection, less than 3 minutes between a parking structure and the main entry lobby is recommended for easy accessibility	***PW, EH***
B	Clear signage and wayfinding elements for locating and entering the main lobby are necessary.	***PW, EH***
C	Drop off and pick up areas for vehicles should be covered, for protection from harsh weather conditions.	***PW, EH***
D	Bicycle lots or storage areas may encourage visitors' physical activity and community involvement.	***PW, EH, SI***
E	Clear separation among a pedestrian entrance, area for vehicle drop off, and a bicycle path can prevent injury caused by collisions.	***PW, EH, SI***

To improve users' entry vestibule experience, the following design criteria are recommended:		
		
A	A vestibule or wind lock is necessary for preventing a draft in winter.	***PW***
B	Easily opened and wide doors or automatic doors with pressure-sensitive buttons should be provided for users with a wheelchair or who push a baby stroller or similar device.	***PW***
C	An entry vestibule should have no obstructions at entranceways.	***PW, EH***
D	Space should be provided for a wheelchair storage area out of the path of traffic.	***PW, SI***
E	A small waiting area for discharge, with a view of the drop off and pick-up area, is recommended.	***PW, EH, SI***

To improve users' waiting experience,
the following design criteria of basic space program are recommended:

A	The main entry lobby should include a counter or desk for reception and information, a public waiting area, public restrooms for male, female, and family, and private waiting areas for special groups of people, such as patients on stretchers.	***PW, EH, SI***
B	Clear physical boundaries should exist to separate the information/ welcome center, waiting area, registration check-in area and main circulation hallway.	***PW, EH, SI***
C	Public circulation and staff/ patient circulation should be separated wherever possible.	***PW, EH, SI***
D	The main lobby needs comfortable places to wait.	***PW, EH***
E	Self-check-in kiosks can increase the efficiency of the check-in process.	***PW, EH, SI***

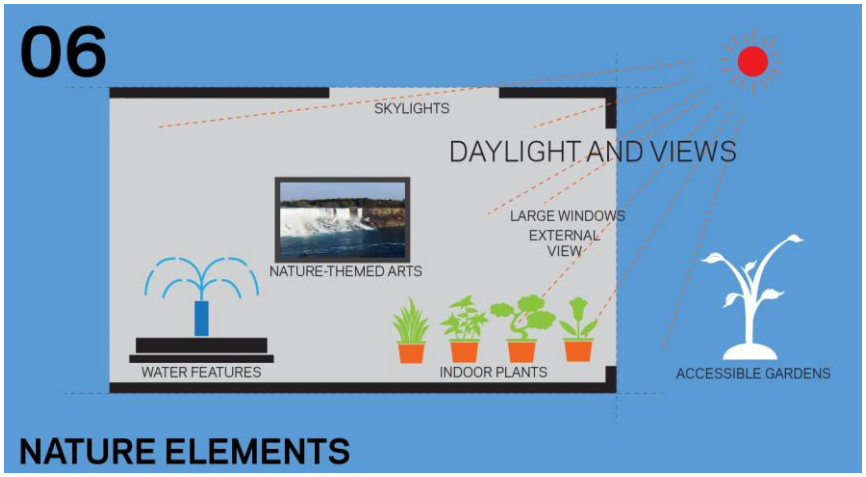
To improve users' waiting experience, the following design criteria of additional space program are recommended:

A	Easy access to the Internet through a wireless connection, power outlets, cellphone charger, and a phone for making local phone calls should be available.	***EH, SI***
B	Kiosks offering information regarding healthier life, nutrition, the facility, waiting time, current time, and educational programs should be presents.	***PW, EH, SI***
C	Drinking water should be easily accessible to all visitors.	***PW, EH***
D	An enclosed vending area in the lobby is recommended.	***PW, EH, SI***
E	Children's area with hard toys and hard books for children of different ages is recommended.	***PW, EH, SI***
F	A multi-purpose room is recommended for such special purposes as lactation, visitors' respite.	***PW, EH, SI***

To improve users' main entry lobby experience, the following design criteria related to accessibility to other space are recommended:

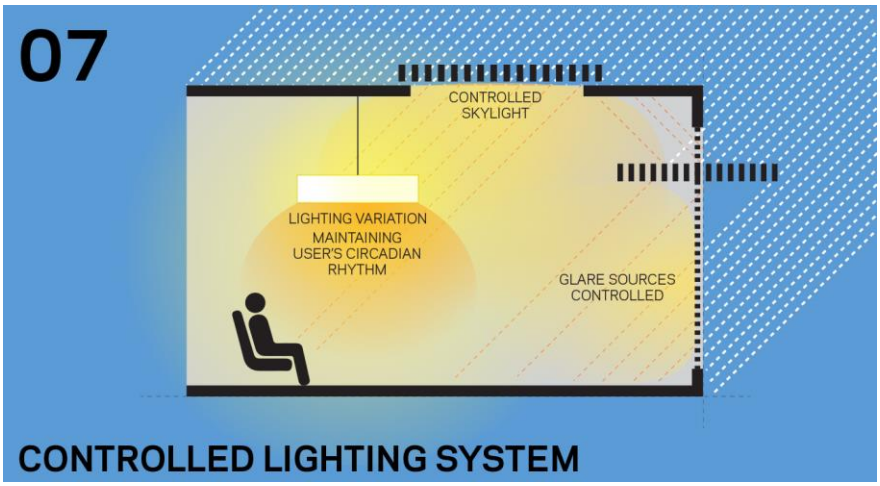
A	Clear signage (location, languages, symbols, color coding) is important for the user's better understanding of locations of various services.	***PW, EH***
B	You-Are-Here maps provide a better understanding of the overall structure of the facility.	***PW, EH***
C	Interior landmarks (water feature, major art, distinctive color) may aid users in cognitive understanding of their destinations.	***PW, EH, SI***
D	Easy accessibility to a café, dining area, gift shop, book store or convenience store, chapel, family library, business center, conference rooms, outdoor gardens, and an exercise facility is recommended.	***PW, EH, SI***

To optimize positive distractions, the following design criteria related to nature elements are recommended:



A	Large windows and skylights to provide natural daylight and views to the outside may enhance the positive waiting experience for users.	***PW, EH***
B	Providing accessible indoor gardens or outdoor gardens may affect users' positive sensory experience.	***PW, EH, SI***
C	Design cues from local scenery, geographic elements, nature-themed artwork and panoramic vistas may allow users to feel more comfortable and relaxed.	***EH, SI***
D	Water features can offer positive visual as well as auditory stimuli.	***PW, EH***

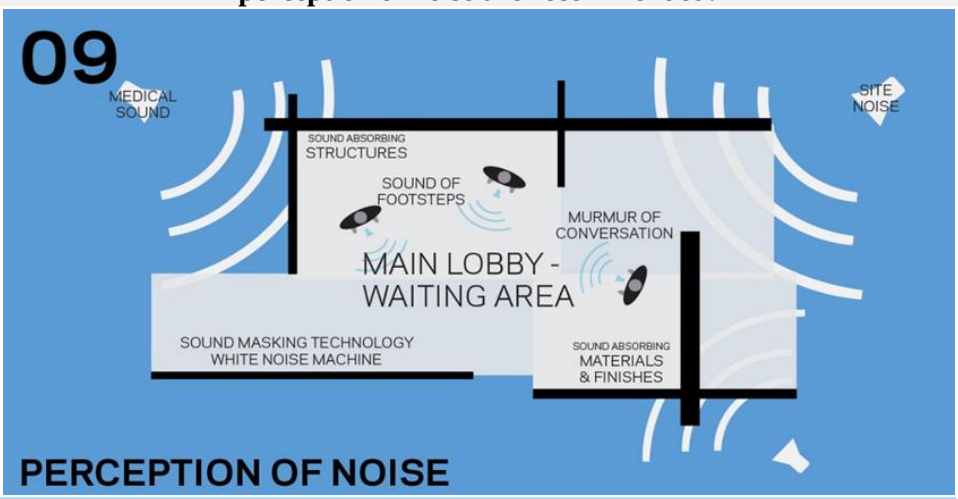
To optimize positive distractions, the following design criteria related to controlled lighting system are recommended:



A	Overall conditions of lighting, including both interior lighting and lighting from the outside, support users' sense of comfort.	***PW, EH***
B	Glare on the floor and other surfaces should be minimized by a controlled window shading system.	***PW, EH***
C	Various lighting sources should be provided for the purpose of maintaining users' circadian rhythm.	***PW, EH, SI***
D	The aesthetics of lighting elements (intensity and color of a light source, and types of lighting fixture) should be considered carefully.	***PW, EH, SI***

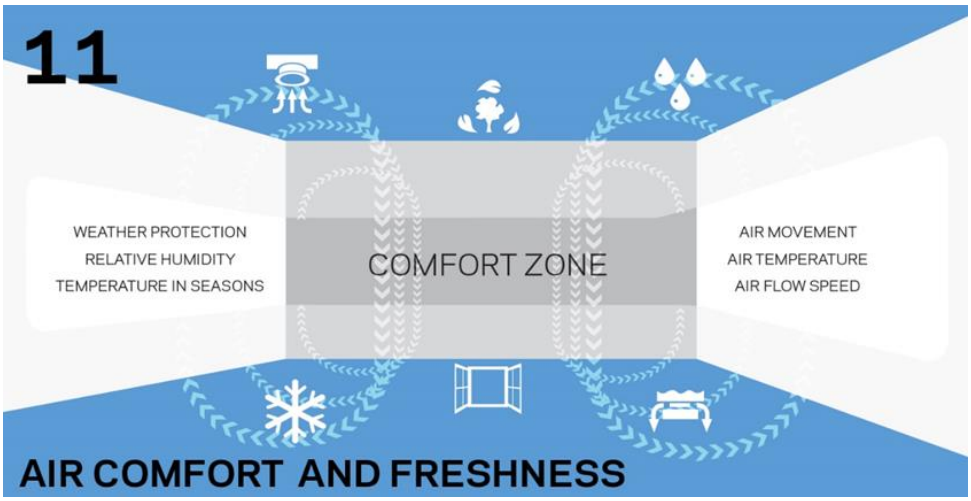
To optimize positive distractions, the following design criteria related to visual appeals are recommended:

A	The physical environment of the main lobby should be visually appealing by utilizing attractive finishes, nature-themed artwork, soft materials, and harmonizing colors.	***PW, EH***
B	The design of the main entry lobby should meet hospital brand identities.	***EH, SI***

	To optimize positive distractions, the following design criteria related to perception of noise are recommended:	
		
A	Noise from outside of the building should be minimized by use of sound-absorbing construction materials and finishes, and/or white noise machines.	***PW, EH***
B	Noise from equipment should be minimized by use of sound-absorbing materials.	***EH***
C	Sound from human activities, such as the murmur of conversations, sound of footsteps, and sounds of chairs being moved, should be minimized by use of white noise machine, water features, and sound-absorbing materials.	***PW, EH, SI***

	To optimize positive distractions, the following design criteria related to positive sound distractions are recommended:	
		
A	The sound from nature elements such as water features, indoor healing gardens should be accessible to various user groups.	***PW, EH, SI***
B	Soothing music should be available to users.	***EH***
C	White noise/ sound masking technology should be used to reduce disruptions caused by noise.	***EH***

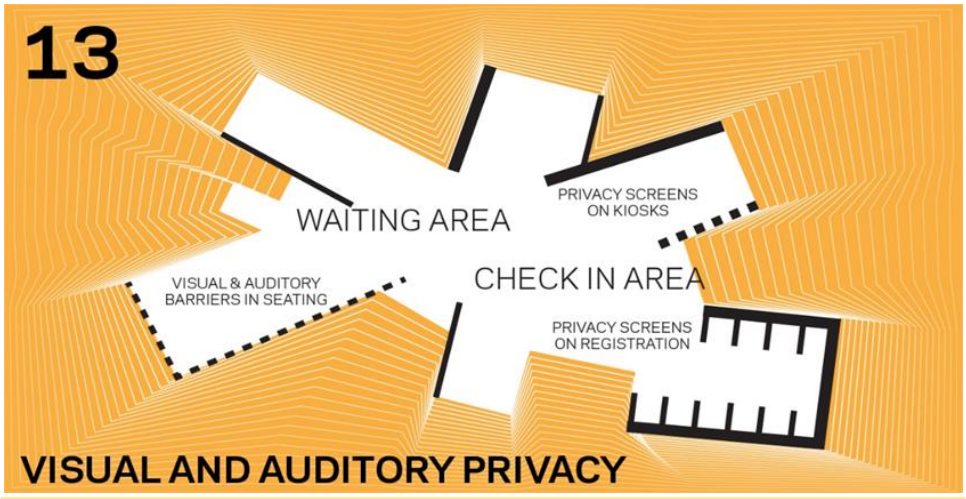
To optimize positive distractions, the following design criteria related to air comfort and freshness are recommended:



A	Air temperature, relative humidity, air freshness, and air flow speed should be in the comfort range.	***PW, EH***
B	Unpleasant odors such as the smell of disinfectants, or food odors from a cafeteria, should be minimized.	***PW, EH***
C	Ventilation and air conditioning systems should accommodate temperature differences during seasons.	***PW***

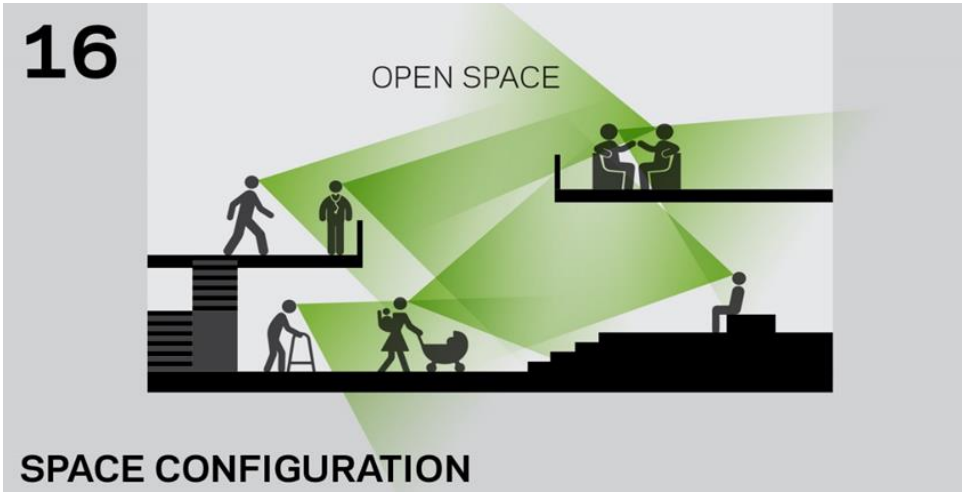
To enhance users' sense of control, the following design criteria related to environmental support for physical activity are recommended:

A	The main entry lobby should provide environmental support for physical activity such as highly visible staircases, attractive staircase design, and multiple signs (elevators, video, posters, pamphlets) for encouraging users' physical activities and prevention of overweight or obesity.	***PW, SI***
B	Environmental support for users' recreation, such as indoor climbing, indoor healing gardens, and meditation gardens are recommended.	***PW, EH, SI***
C	Offers of free or subsidized body composition measurements, including height, weight, and BMI score; blood pressure measurements, and blood sugar assessment, are suggested as ways of increasing users' awareness of health.	***PW, EH***

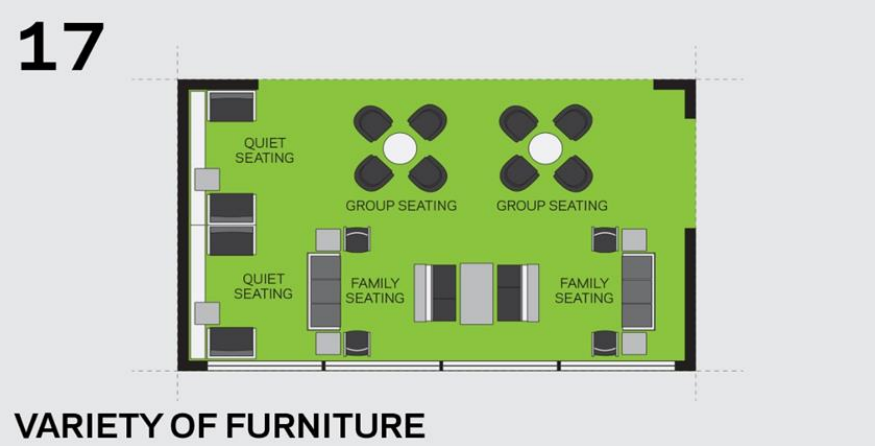
	To enhance users' sense of control, the following design criteria related to visual and auditory privacy are recommended:	
		
A	Furniture configurations that provide visual and auditory privacy in the lobby waiting area are recommended.	***EH, SI***
B	Providing privacy screens on both registration kiosks and check in desk are necessary for preventing the release of personal information.	***EH, SI***
C	Speech privacy at open spaces should be maintained.	***EH, SI***
D	Providing audio barriers at the registration area and visual barriers between seating areas is recommended.	***PW, EH, SI***

	To enhance users' sense of control, the following design criteria related to user controlled environments are recommended:	
		
A	Furniture should be easily adjusted to increase comfort of various users.	***PW, EH, SI***
B	Flexible furniture layouts that accommodate various waiting experiences allow the user to change the arrangement.	***PW, EH, SI***
C	The shading system in a waiting space should be controllable by visitors.	***PW, EH***
D	A quiet space where the user can engage in relaxation activities, such as deep breathing, is suggested.	***PW, EH***
E	Space for storage of personal belongings is recommended.	***PW, EH***

	To enhance users' sense of control, the following design criteria related to providing information for achieving a healthier life are recommended:	
		
A	Brochures, posters, pamphlets or other written or online information that address healthy eating, overweight, and obesity should be provided.	***PW***
B	Nutritional information on foods and beverages sold in the vending machine area should be provided.	***PW***
C	Information on farmers' markets where fresh fruits and vegetables are sold should be provided.	***PW, SI***
D	Information on educational seminars, workshops, or classes on weight management that are offered by the facility should be provided.	***EH, SI***

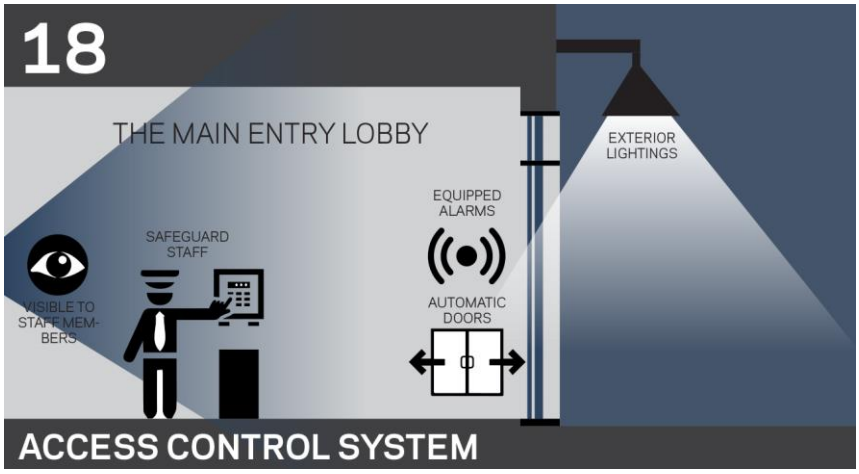
	To increase users' social support, the following design criteria related to space configuration are recommended:	
		
A	High vertical visibility and high horizontal visibility within spaces, such as high ceilings, or open spaces for increasing visual interaction and accessibility, should be provided.	***PW, EH, SI***
B	Open space for collaborative events should be provided.	***PW, EH, SI***
C	The lobby should be located with high spatial connectivity, to increase the efficiency of finding or moving to users' destinations.	***PW, EH***

To increase users' social support, the following design criteria related to variety of furnishings are recommended:



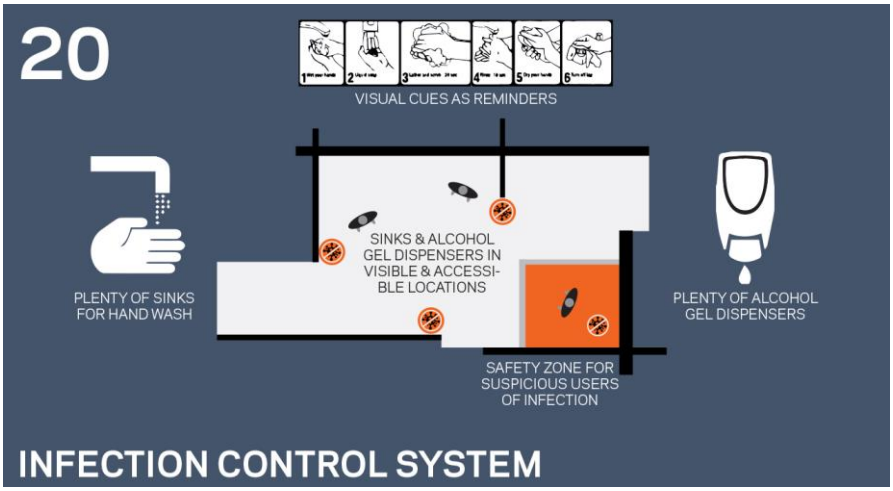
A	The main lobby should provide various types of furniture for different groups of people, such as children, elderly people, obese people, wheelchair users, and those with stroller.	***PW, EH, SI***
B	A waiting area should have various sizes and layouts of furniture, such as group seating, family seating, and seating for quiet areas, to accommodate different group sizes.	***PW, EH, SI***
C	A seating area should offer options for adjustable seating and flexibility of seating layout.	***PW, EH, SI***

To enhance safety and security, the following design criteria for access control system are recommended:



A	Exit doors should automatically close when no one is using them.	***PW, EH***
B	Alarm systems should be present, to prevent unauthorized entry into the patient interaction space.	***PW, EH, SI***
C	All public areas and the entrances should be visible to staff members located in the registration area.	***EH, SI***
D	Adequate exterior lighting in parking lots and entry points to the facility, and appropriate reception/ security services, are essential.	***PW, EH***
E	A visitor management system, such as a system of requiring the showing of an ID card, is recommended.	***EH, SI***
F	Video cameras should be in use, to give security personnel a real-time view of what is happening in the main entry lobby.	***EH, SI***

	To increase users' social support, the following design criteria of cleanness and maintenance are recommended:	
		
A	Overall cleanness should be maintained in the waiting area.	***PW, EH, SI***
B	Public restrooms should be maintained and kept clean.	***PW, EH, SI***
C	There should be minimal ridges, perforations, crevices or reveals that could serve as dust collectors.	***PW, EH***
D	Hard surfaced toys that are easy to clean.	***PW***
E	Surfaces and finishes should be easy to clean and maintain.	***PW***

	To increase users' social support, the following design criteria related to infection control system are recommended:	
		
A	Sufficient sinks and/or alcohol gel dispensers should be provided in visible and accessible locations in the main entry lobby.	***PW, EH, SI***
B	Visual cues such as posters and/or signage should be provided as reminders of the need hand washing and hand sanitization.	***PW, EH***
C	Warning signs directed at visitors should be posted to explain the serious consequences of transmitting infections to patients and others.	***PW, SI***
D	A separate or isolated space is needed for patients with contagious diseases.	***PW, SI***

CHAPTER VI

DISCUSSION AND CONCLUSIONS

Overview

The primary goal of this study is to create and validate evidence-based design evaluation criteria focused on the wellness experience of users of the main entry lobby of a healthcare facility. This chapter has two goals. First, it aims to discuss how the proposed wellness design evaluation criteria and tool should be used in assessment of a healthcare physical environment, and what implications are produced by testing the tool and analyzing the test results. Second, it suggests recommendations a future research, followed by overall conclusions.

Practice of Testing a Wellness Design Evaluation Tool: A Case Study

In this chapter, the testing procedure and the results of the wellness design evaluation will be presented. These processes are valuable in identifying the difficulties of using the tool, and what information an evaluator might obtain during and after the assessment.

The tool was tested at the main entry lobby of three different healthcare facilities. Prerequisites for the selection of a testing site were as follows: First, the facility should be located in Iowa, the residence of participants in the online survey. Second, each healthcare facility is defined a hospital. Third, the driving distance between the site and the researcher's location should be less than two hours each way for reasons of time and expense.

To access the main entry lobby of the three healthcare facilities, the researcher contacted either the architecture firm that designed the facility or the facility's public

relations department. The researcher requested permission to test the tool through observation, using each facility's floor plans. Onsite photos were documented to test the tool and analyze the results.

The procedure of testing the wellness design evaluation tool began by visiting a facility's main entry lobby area and observing the environment for 30 minutes, after which the researcher completed the evaluation using the wellness design evaluation tool, a combination of tables and diagrams printed on paper. Completing the test took approximately 20 minutes. Finally, the researcher took photos of the lobby for reference. If a facility refused permission for the sake of patient privacy, the researcher asked for photos of the architectural firm who had designed the lobby. The researcher attempted to avoid including people in the photos, if they were present, they were rendered unrecognizable.

Table 6.1 shows the summarized information of the case study.

Table 6.1. Summary of a case study for testing wellness design evaluation tool

	Type A	**Type B**	**Type C**
Type of facility	A 220-bed regional hospital	A 146-bed, community hospital	Cancer center (Research, education, & patient care)
Completion year	2016	2009	2013
SQ.FT of the lobby	7200	7800	5700
Levels of the lobby	1st, 2nd levels	1st, 2nd levels	1st level
Duration of observation	30 minutes	40 minutes	30 minutes
Duration of filling the evaluation tool	20 minutes	30 minutes	15 minutes

Type A Hospital

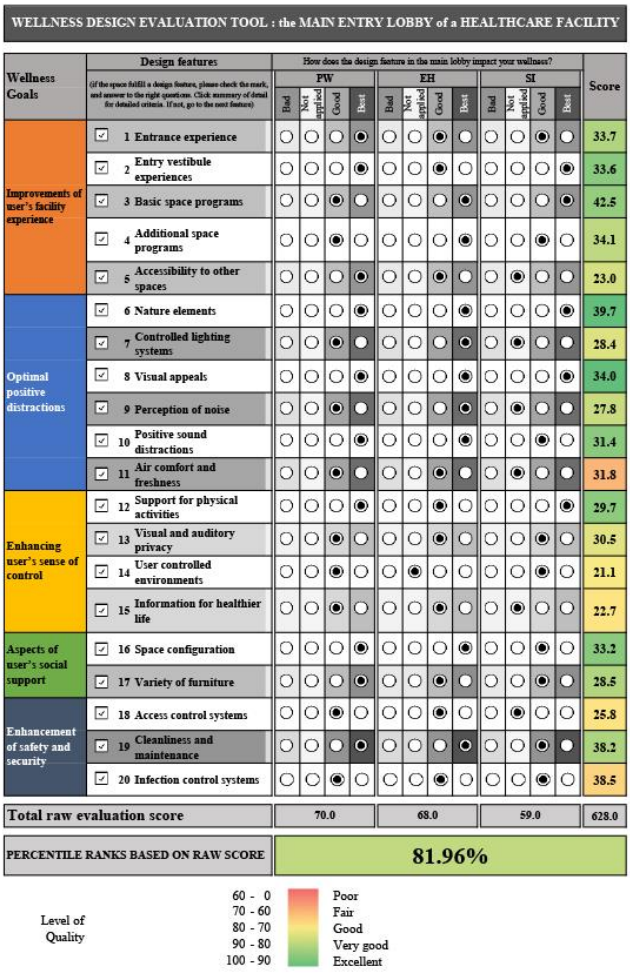
Wellness Design Goals	Design features (if the space fulfill a design feature, please check the mark, and answer to the right questions. Click summary of detail for detailed criteria. If not, go to the next feature)	How does the design feature in the main lobby impact your wellness? PW Bad	PW Not applic	PW Good	PW Best	EH Bad	EH Not applic	EH Good	EH Best	SI Bad	SI Not applic	SI Good	SI Best	Score
Improvement of user's experience	☑ 1 Entrance experience	○	○	○	◉	○	○	◉	○	○	○	◉	○	33.7
	☑ 2 Entry vestibule experience	○	○	○	◉	○	○	○	◉	○	○	○	◉	36.6
	☑ 3 Basic space program	○	○	◉	○	○	○	◉	○	○	○	◉	○	34.8
	☑ 4 Additional space program	○	○	◉	○	○	○	◉	○	○	○	◉	○	30.7
	☑ 5 Accessibility to other space	○	○	○	◉	○	○	◉	○	○	○	◉	○	25.5
Optimal positive distraction	☑ 6 Nature elements	○	○	○	◉	○	○	○	◉	○	○	◉	○	36.3
	☑ 7 Controlled lighting system	○	○	◉	○	○	○	○	◉	○	○	◉	○	31.5
	☑ 8 Visual appeals	○	○	◉	○	○	○	○	◉	○	○	○	◉	31.2
	☑ 9 Perception of noise	○	◉	○	○	○	○	◉	○	○	◉	○	○	21.6
	☑ 10 Positive sound distractions	○	◉	○	○	○	○	◉	○	○	○	◉	○	22.9
	☑ 11 Air comfort and freshness	○	○	◉	○	○	○	◉	○	○	◉	○	○	31.8
Enhancing user's sense of control	☑ 12 Environmental support for physical activities	○	○	○	◉	○	○	○	◉	○	○	◉	○	29.7
	☑ 13 Visual and auditory privacy	○	◉	○	○	○	○	◉	○	○	○	◉	○	27.1
	☑ 14 User controlled environments	○	◉	○	○	○	◉	○	○	○	◉	○	○	15.8
	☑ 15 Information for healthier life	○	○	◉	○	○	○	◉	○	○	◉	○	○	22.7
Aspects of social support	☑ 16 Space configuration	○	○	○	◉	○	○	◉	○	○	○	○	◉	33.2
	☑ 17 Variety of furniture	○	○	◉	○	○	○	◉	○	○	○	◉	○	25.6
Enhancement of safety and security	☑ 18 Access control system	○	○	○	◉	○	○	○	◉	○	○	◉	○	35.4
	☑ 19 Cleanness and maintenance	○	○	○	◉	○	○	○	◉	○	○	◉	○	38.2
	☑ 20 Infection control system	○	○	◉	○	○	○	○	○	○	○	○	○	34.3
Total raw evaluation score				64.0				66.0				58.0		598.6
PERCENTILE RANKS BASED ON RAW SCORE				78.12%										

Figure 6.1. *Results of wellness design evaluation of type A hospital*

Type A hospital is a 220 bed, full service, regional hospital. The main entry lobby of type A hospital was renovated in 2016, and the valet parking area and the outside area of the hospital was under construction. Figure 6.1 indicates the assessment result for Type A hospital. Overall, percentile rank based on raw scores was 78.12, a good status. As stated in Chapter Six, the yellowish-green color indicates that the results for the design features are above a user's mean expectation. In contrast, a red color indicates that a result is below the user's mean expectations. Results for entry vestibule experience, nature elements, visual appeals, support physical activities, space configuration, and access control system are all above the user's mean expectations, while results for user controlled environment, perception of noise, air comfort and freshness, and infection control system are below the user's mean expectations. Figure 6.2 shows floor plan and photos of the space and the researcher's documentation of observations.

Figure 6.2. *Type A 1st level floor plan with photos showing design features and detailed elements related to the perception of user's wellness experience*

Type B Hospital



WELLNESS DESIGN EVALUATION TOOL : the MAIN ENTRY LOBBY of a HEALTHCARE FACILITY

Wellness Goals	Design features (if the space fulfill a design feature, please check the mark, and answer to the right questions. Click summary of detail for detailed criteria. If not, go to the next feature)	How does the design feature in the main lobby impact your wellness? PW: Bad / Not applied / Good / Best	EH: Bad / Not applied / Good / Best	SI: Bad / Not applied / Good / Best	Score
Improvements of user's facility experience	1 Entrance experience	○ ○ ○ ◉	○ ○ ◉ ○	○ ○ ◉ ○	33.7
	2 Entry vestibule experiences	○ ○ ○ ◉	○ ○ ◉ ○	○ ○ ○ ◉	33.6
	3 Basic space programs	○ ○ ◉ ○	○ ○ ○ ◉	○ ○ ○ ◉	42.5
	4 Additional space programs	○ ○ ◉ ○	○ ○ ○ ◉	○ ○ ◉ ○	34.1
	5 Accessibility to other spaces	○ ○ ○ ◉	○ ○ ◉ ○	○ ◉ ○ ○	23.0
Optimal positive distractions	6 Nature elements	○ ○ ○ ◉	○ ○ ○ ◉	○ ○ ○ ◉	39.7
	7 Controlled lighting systems	○ ○ ◉ ○	○ ○ ○ ◉	○ ◉ ○ ○	28.4
	8 Visual appeals	○ ○ ○ ◉	○ ○ ○ ◉	○ ○ ○ ◉	34.0
	9 Perception of noise	○ ○ ◉ ○	○ ○ ○ ◉	○ ◉ ○ ○	27.8
	10 Positive sound distractions	○ ○ ○ ◉	○ ○ ○ ◉	○ ○ ◉ ○	31.4
	11 Air comfort and freshness	○ ○ ◉ ○	○ ○ ◉ ○	○ ◉ ○ ○	31.8
Enhancing user's sense of control	12 Support for physical activities	○ ○ ○ ◉	○ ○ ◉ ○	○ ○ ○ ◉	29.7
	13 Visual and auditory privacy	○ ○ ◉ ○	○ ○ ◉ ○	○ ○ ◉ ○	30.5
	14 User controlled environments	○ ○ ◉ ○	◉ ○ ○ ○	○ ○ ◉ ○	21.1
	15 Information for healthier life	○ ○ ◉ ○	○ ○ ◉ ○	○ ◉ ○ ○	22.7
Aspects of user's social support	16 Space configuration	○ ○ ○ ◉	○ ○ ○ ◉	○ ○ ◉ ○	33.2
	17 Variety of furniture	○ ○ ○ ◉	○ ○ ◉ ○	○ ○ ◉ ○	28.5
Enhancement of safety and security	18 Access control systems	○ ○ ◉ ○	○ ○ ◉ ○	○ ◉ ○ ○	25.8
	19 Cleanliness and maintenance	○ ○ ○ ◉	○ ○ ○ ◉	○ ○ ◉ ○	38.2
	20 Infection control systems	○ ○ ◉ ○	○ ○ ◉ ○	○ ○ ◉ ○	38.5
Total raw evaluation score		70.0	68.0	59.0	628.0
PERCENTILE RANKS BASED ON RAW SCORE		81.96%			

Level of Quality: 60 - 0 Poor; 70 - 60 Fair; 80 - 70 Good; 90 - 80 Very good; 100 - 90 Excellent

Figure 6.3. *Results of wellness design evaluation of type B hospital*

Type B hospital is a 146-bed community hospital on a university campus. The main entry lobby was completed in 2009 and is on the second level.

Figure 6.3 shows the assessment results for type B. Overall percentile rank based on raw scores was 81.96, a very good status. The green color indicates that the results of the overall design features are above the survey results representing respondents' mean expectations. Entry vestibule experience, nature elements, visual appeals, positive sound distractions, support for physical activities, and space configurations had high scores as shown by the green color, and only air comfort and freshness needed improvement. Figure 6.4 shows the floor plans of type B hospital, photos of the space and the researcher's documentation of observation.

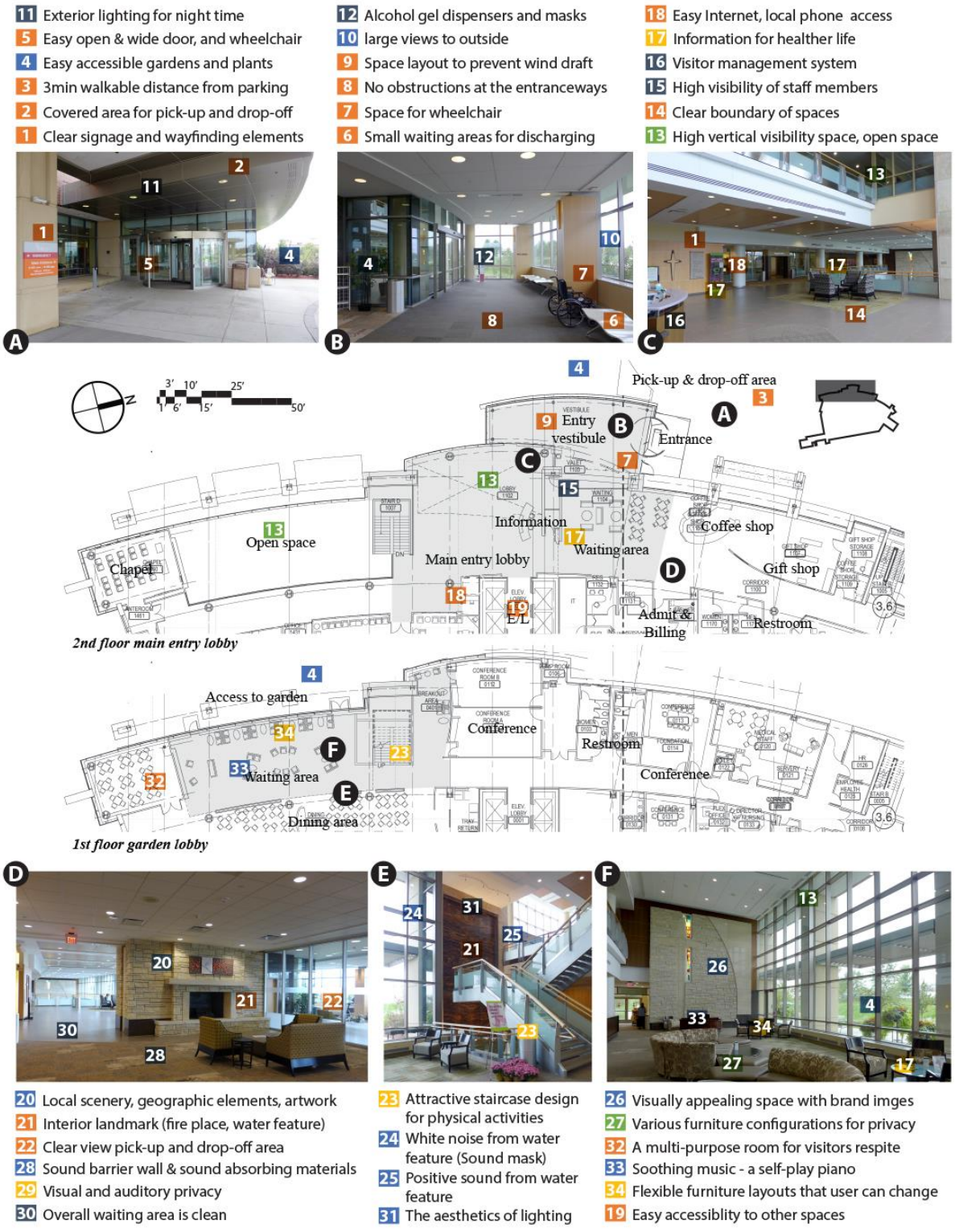


Figure 6.4. *Type B 1st and 2nd level floor plan with photos, showing design features and detailed elements related to the perception of user's wellness experience.*

Type C Hospital

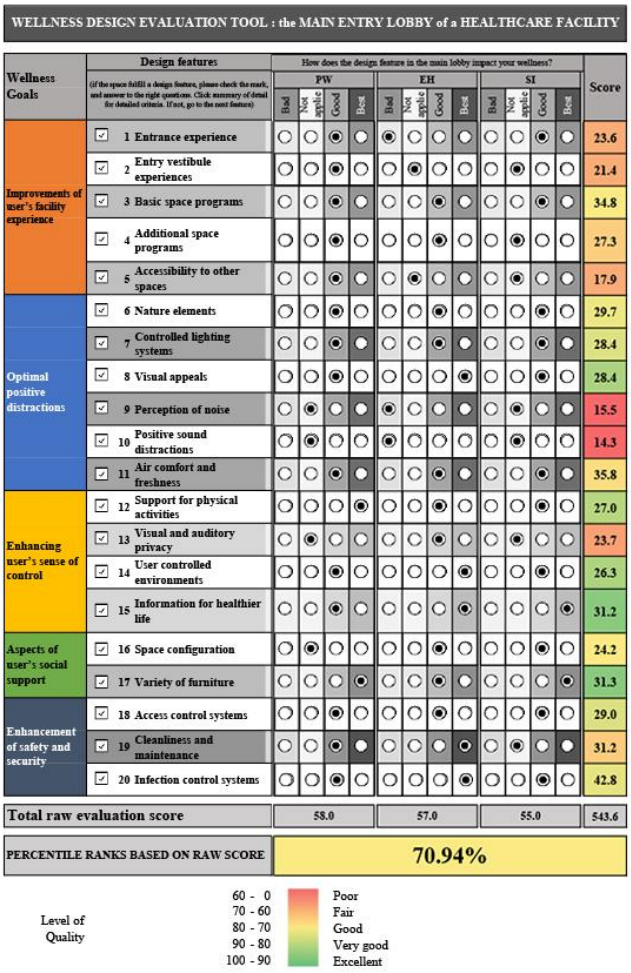


Figure 6.5. *Results of wellness design evaluation of type C hospital*

Type C hospital is a cancer treatment center on a university campus. Various departments share the building with the center. The building was completed in 2009. There are two ways to access the main entry lobby, one from the first level and the other from the second level that connects directly with a parking structure through a sky bridge. In this test, the researcher chose to access the main entry lobby from the first level.

Figure 6.5 indicates the assessment results of type C hospital. Overall percentile ranks based on raw scores was 70.94, a good status. The green color indicates that the test results of the overall design features were above the survey result representing respondents' mean expectation. User-controlled environment, information for healthier life, and variety of furniture had high scores as shown by the green color. In contrast, perception of noise, positive sound distractions, and visual and auditory privacy needed improvement. Figure 6.6 provides an idea as to how to evaluate and record an assessment at a project site.

Figure 6.6. *Type C 1st level floor plan with photos, showing design features and detailed elements related to the perception of user's wellness experience*

Discussion of Using a Wellness Design Evaluation Tool

In the previous section evaluation of three healthcare facilities was described in terms of the wellness design evaluation tool and criteria used by the researcher. On the basis of the test results, the researcher identified some important aspects of using the tool.

First, an evaluator can consider the 20 design features in depth to improve their quality. Although an evaluator can assess the features without considering physical, emotional, and social wellness, this type of evaluation will check only whether or not the design features are present in the space. In contrast, results based on wellness design evaluation criteria can represent how a user perceives the design features of a space with regard to various aspects of wellness.

Next, an evaluator can recognize which design features need improvement. Use of the criteria related to the design features of a healthcare facility's main entry lobby can indicate whether the features satisfy users' expectations or not based on their previous healthcare facility experiences. If an evaluation result exhibits a reddish color, the design feature needs to be added or changed to improve users' experiences in the lobby.

Finally, with respect to results produced by the researcher's tests of the tool, the results may be impacted by familiarity with the space and the tool. Because the tool gauges users' healthcare facility lobby experiences, results of using the tool for assessing a lobby are somewhat subjective because of evaluator experiences such as length of observation, hearing about the intention of design features from a facility manager, and understanding the tool itself, all of which may affect the evaluator's assessment.

Recommendations for Future Research

This study involved a limited number of population groups and geographical areas because of financial and time issues. Further study should involve a broader selection of populations with diverse backgrounds and geographic locations to obtain more accurate data. Another limitation of the study is that the results were obtained through an online survey that required accessibility to and familiarity with the Internet and associated technology in responding to the questionnaire. To collect more reliable data, hybrid survey methods such as use of an online survey with a personal in-home survey would be recommended for future research. In assessment of user's wellness design experience, the selected methods, content analysis, and surveys are not the only possible methodology for developing design criteria and evaluation tools. For example, in-depth user observation or structured interviews of main entry lobby users to supplement content analysis would be a different way to learn about users' wellness design experiences for future research.

Additionally, this study had the limitation of deploying only research-proven design evaluation tools and design guidelines for enhancing a user's healthcare facility experience. Information relative to such experience should be research-based and use evidence-based wellness design evaluation criteria so that the tool's application would be inclusive to all user groups. The WELL Building Standard (WELL), launched as a pilot program in mid-2015 (Holowka, 2015), is one of the recent design guidelines relevant to this study. WELL addresses "the opportunity to design and build with a human-centered approach, which ultimately supports the industry in comprehensively addressing human health" (International Well Building Institute. n.d., para.3). This standard could be included in performing content analysis for future research.

For future research, validation of the tool with participants with different backgrounds would be recommended because the study has limitations associated with testing the tool. To minimize the subjectivity with respect to the testing result of the tool, it should be tested in different user groups, including designers, patients, visitors, or staff in a healthcare facility's main entry lobby.

Conclusions

This study began with the research question: What wellness design criteria could be addressed and which design features should be assessed for evaluating user-centered wellness design experience in the main entry lobby of a healthcare facility?

According to previously reviewed theories and current design-related issues that impact wellness of healthcare environment users, five wellness design criteria related to minimizing negative user experiences in the main entry lobby of a healthcare facility were selected. Recent studies have revealed that stress is a major problem that works against wellness. Therefore creating a healing environment, adopting supportive design theory, and applying active design guidelines for a healthcare facility's lobby design could reduce user stress.

To identify design features related to the wellness design criteria, six existing design evaluation tools and guidelines were examined as elements of content analysis. In particular, a Patient Room Post Occupancy Evaluation Tool and a Clinic Design Post Occupancy Evaluation Toolkit, both from The Center for Health Design, were newly developed POE tools focused on patient experience. Based on the results of the study, these two tools were found to be most important as the basis for developing a user-centered wellness design

evaluation tool because they provided depth and diversity in the research study related to user experience in healthcare environment design. Using the six newly updated wellness design tools and guidelines, a set of questions were prepared for a pilot study that was followed by the actual survey using a full questionnaire.

The survey investigated the criteria and design features by answering the following research questions: How important are the design features with respect to user experience and how can they impact a user's perception of physical well-being, emotional health, and social interaction, and how do various user groups with differing demographics and visiting patterns experience the concept of wellness in the main entry lobby of a healthcare facility?

The result of the survey revealed that the participants had various perceptions about the importance of design features; these perceptions were correlated to each feature's impact on three types of wellness experience. "Enhancement of safety and security" was recognized as the most important criterion of the five wellness criteria, and "Improvement user's experience" was next more important. Although some design features exhibited significant differences with regard to response to demographic and visiting pattern questions, it is assumed that this data would have little impact on the evaluation results for the study. Based on the content analysis and the survey, an Excel-based wellness design evaluation tool was developed and tested at three different hospitals in the state of Iowa. From the testing results the researcher evaluated the overall quality of each main entry lobby and determined which design features should be reconsidered to improve user's wellness experience in the healthcare facility's main entry lobby.

This study produced a framework for creating a user-centered wellness design evaluation tool. While the concept of health and well-being has been mainly centered

particularly on design of healthcare environments (Kraus & Renner, 2016), the researcher speculates that this framework could be used for creating tools for evaluating user wellness experience with respect to many other building typologies.

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NOMENCLATURE

AAHID	American Academy of Healthcare Interior Designers
AEA	American Evaluation Association
ASID	American Society of Interior Designers
BOSSA	Building Occupants Survey System Australia
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CDPOE	Clinic Design Post Occupancy Evaluation Toolkit
CHD	Center for Health Design
CGI	Clinton Global Initiative
CWHSC	Centers for Disease Control and Prevention Work Health Score Card
EBD	Evidence-Based Design
EVS	Environmental Service
FFG	Federal Facilities Council
FGI	Facility Guidelines Institute
HAIs	Healthcare-Associated Infections
HCAHPS	Hospital Consumer Assessment of Healthcare Providers and Systems
HHS	United State Health and Human Services
HP2020	Healthy People 2020
HRQOL	Health-Related Quality of Life
HWP	Health and Wellness Protocol
IDPH	Iowa Department of Public Health

IDHS	Iowa Department of Human Services
IHI	Institute for Healthcare Improvement
I-WALK	Iowan's Walking Assessment Logistics Kit
LEED	Leadership in Energy and Environmental Design
OHE	Optimal Healing Environment
PNI	Psychoneuroimmunology
POE	Post Occupancy Evaluation
PRPOE	Patient Room Post Occupancy Evaluation Tool
SIM	State Innovation Model
USGBC	U.S. Green Building Council
WHO	World Health Organization
WIC	Women, Infants, and Children

APPENDIX A

IRB SURVEY APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 6/6/2016

To: Yongyeon Cho
50C Schilletter Village
Ames, IA 50010

CC: Dr. Jihyun Song
158 College of Design

From: Office for Responsible Research

Title: A survey of user's wellness design experience within the main entry lobby in a healthcare facility

IRB ID: 16-267

Study Review Date: 6/2/2016

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**

- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B

INFORMED CONSENT DOCUMENT

INFORMED CONSENT

Title of Study: A survey of user's wellness design experience within the main entry lobby in a healthcare facility

Investigator: Yongyeon Cho (graduate student and principle investigator)

This form describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part. Your participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding to participate.

INTRODUCTION

The purpose of this study is to assess user's wellness experience within a main entry lobby in a healthcare facility and to identify which design elements of the physical environment are attributing to or detracting from user's wellness experiences. You are being invited to participate in this study because your voluntary participation in the survey leads me to believe that you have an interest in healthcare and would therefore likely want to help with a study to improve user experience in a healthcare physical environment. You should not participate if you are under 18 years old, or have no healthcare facility experience in Iowa in the last 12 months.

DESCRIPTION OF PROCEDURES

If you agree to participate, you will be asked to complete a survey about your wellness experience in a main entry lobby in a healthcare facility. Your participation will continue to complete this survey which I expect will last approximately 20 minutes to complete the survey. The participants will be asked to answer 20 main questions which relates to user experience in a healthcare facility main entry lobby. Each design elements will be analyzed for 3 wellness categories which are physical well-being, emotional health, and social interaction. Additionally, the participant will how important each design element is. The participant may rely on his/her own memory of experiences in healthcare entry main lobbies where the individual have experienced the most frequently. The experience can be multiple times. You may stop the survey at any time that you do not wish to answer, or that makes you uncomfortable. The survey will remain confidential.

RISKS

While participating in this study you may experience the following risks: There are no foreseeable risks at this time from participating in this study. All participation will be voluntary and no identification outside of you being a study participant will be required. Nor will any type of identification be recorded other than the total number of participants.

BENEFITS

If you decide to participate in this study there may be no direct benefit to you, but the result may impact developing a wellness design evaluation criteria for a healthcare facility main entry lobby. It is hoped that the information gained in this study will benefit society by analyzing facts of wellness design elements in healthcare facilities needing improvement. Recommendations can be made to healthcare facility officials for potential improvements which would benefit future users of healthcare facilities.

COSTS AND COMPENSATION

You will have a chance to win a random drawing from participating in this study. A random drawing will be held for five $25 Amazon gift cards (electronic gift cards) for all participants who complete the survey by July 31, 2016. At the end of each survey, all participants will be asked for their email address to enter the lottery. In September, the winners will be randomly selected by Microsoft Excel. And the gift card will be sent to the winners via email. You will be compensated for participating in this study. You will need to complete a form to receive payment. Please know that payments may be subject to tax withholding requirements, which vary depending upon whether you are a legal resident of the U.S. or another country. If required, taxes will be withheld from the payment you receive.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: surveys will be numbered for identification rather than using your name, the surveys will be kept at the home of the principal investigator and any spreadsheets or other computer files generated with survey results will be on the principal investigator's password-protected external hard drive. If the results are published, your identity will remain confidential.

QUESTIONS OR PROBLEMS

You are encouraged to ask questions at any time during this study.

For further information about the study contact Yongyeon Cho (graduate student and principle investigator), at 347-656-4753, yongyeon@iastate.edu, or Jihyun Song (major professor overseeing Cho' thesis study) at jsong@iastate.edu

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

****

PARTICIPANT ACCEPTANCE

By checking the agree to participate box below, you verify that you have read the informed consent. Checking the box below indicates that you voluntarily agree to participate in the study, that the study has been explained to you, that you have been given the time to read document, and that your questions have been satisfactorily answered. Because this is an online survey, please print a copy of the informed consent.

Do not agree to participate	Agree to participate

APPENDIX C

ONLINE SURVEY

PRE-Q1. Are you 18 years old, or over 18 years old?

- Yes
- No

PRE-Q2. Have you visited a healthcare facility in Iowa in the last 12 month?

- Yes
- No

>>

PRE-Q3. Please, choose one of the types of healthcare facilities where you are familiar and have more experience than others.

- Hospital (General, small primary care hospitals, critical access hospital, psychiatric hospital, rehabilitation hospital, etc)
- Ambulatory care facility (Outpatient facility, Primary care outpatient center, small primary care, outpatient facility, freestanding outpatient diagnostic and treatment facility, urgent care facility, freestanding cancer treatment facilities, outpatient surgical facility, etc)
- Residential healthcare facility (Nursing facilities, hospice facilities, assisted living facility, etc)
- Other healthcare facility (Mobile, Transportable units, freestanding birth centers, adult day healthcare facilities, etc)

PRE-Q4. How often did you visit the type healthcare facility you chose in the previous question in last one year?

- Less often than once a year
- Once or twice a year
- Once a month
- Twice a month
- Once a week
- Twice a week
- More than four times a week
- Every day/ multiple times a day

PRE-Q5. How long did you stay the healthcare facility in average in a visit?

- Less then 1 hour
- 1 ~ 2 hours
- 2 ~ 4 hours
- 4 ~ 6 hours
- 6 ~ 8 hours
- All day
- Do not know

PRE-Q6. What was the main purpose of your visit?

- as a patient
- as a visitor
- as a volunteer
- as a staff

Survey Completion

INTRO. You selected **one type of healthcare facility** in the early questions that you are the most familiar with. You will **rely on your own experiences and memories** from the chosen facility.

You will be shown **20 design elements** that might **impact your wellness.** You will analyze **how important the each design elements to you is,** and **what impact elements do on your physical well-being, emotional health, and social interaction** in a healthcare main entry lobby.

Physical well-being is the ability to maintain a health quality of life that allows us to get through our daily activities without undue fatigue or physical stress.

Emotional health is the ability to acknowledge and share feelings of hope, love, joy and happiness in a productive manner.

Social interaction is the ability to relate to and connect with other people in our world positively.

Please answer the following questions.

>>

Survey Completion

Entrance experience

A. How ***important*** are the **entrance experiences** ***(e.g. covered area for vehicle drop off and pick up, proximity of parking lots, pedestrian entrance, clear signage, bicycle lots)*** of the main entry in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** do the **entrance experiences** ***(e.g. covered area for vehicle drop off and pick up, proximity of parking lots, pedestrian entrance, clear signage, bicycle lots)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

Survey Completion

Entry vestibule experience

A. How ***important*** are the **entry vestibule experiences** ***(e.g. wheelchair storage area that out of the path of traffic, view of drop off and pick up area, waiting area for discharge)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** do the **entry vestibule experiences** ***(e.g. wheelchair storage area that out of the path of traffic, view of drop off and pick up area, waiting area for discharge)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Access control system

A. How ***important*** are the **access control systems** ***(e.g. protection devices, automatically closed door with alarms, safeguard staff, adequate exterior lighting)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** do the **access control systems** ***(e.g. protection devices, automatically closed door with alarms, safeguard staff, adequate exterior lighting)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

Basic space programs

A. How ***important*** are the **basic space programs** ***(e.g. information center, waiting area, public restrooms for male, female, and family, space for spacial group of people)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B.
What impact do the **basic space programs** ***(e.g. information center, waiting area, public restrooms for male, female, and family, space for spacial group of people)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Additional space programs

A. How ***important*** are the **additional space programs** ***(e.g. kids area, multi-purpose lactation, place of respite, drinking water, local phone calls, power outlets, wireless connection, clock, waiting monitor, vending area, kiosks or other displays for information, clear signage and landmark for wayfinding)*** of the main entry lobby in the healthcare facility to you?

Not at al important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** do the **additional space programs** ***(e.g. kids area, multi-purpose lactation, place of respite, drinking water, local phone calls, power outlets, wireless connection, clock, waiting monitor, vending area, kiosks or other displays for information, clear signage and landmark for wayfinding)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Accessibility to other spaces

A. How ***important*** is the **accessibility to other spaces** ***(e.g. cafe, gift shop, book store, chapel, business center, family library, exercise facility on-site, convenience store)*** of the main entry lobby in the healthcare facility to you?

Not at al important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** does **accessibility to other spaces** ***(e.g. cafe, gift shop, book store, chapel, business center, family library, exercise facility on-site, convenience store)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Space configuration

A. How ***important*** is the **space configuration** ***(e.g. visibility within space, spacial connectivity)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What impact does the **space configuration** ***(e.g. visibility within space, spacial connectivity)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

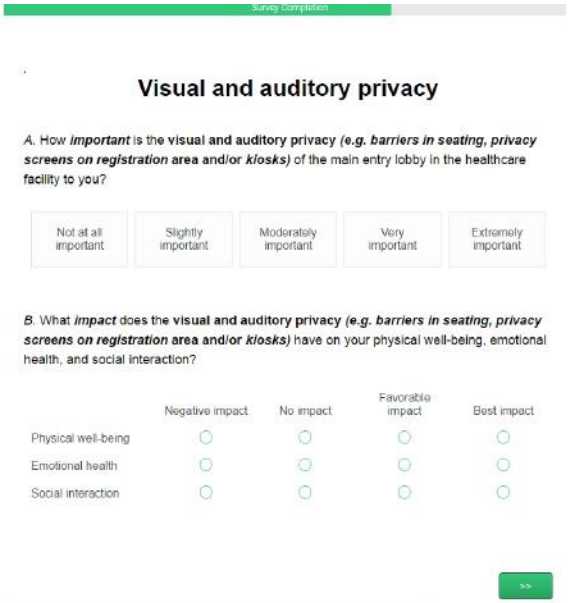
Environmental support for physical activities

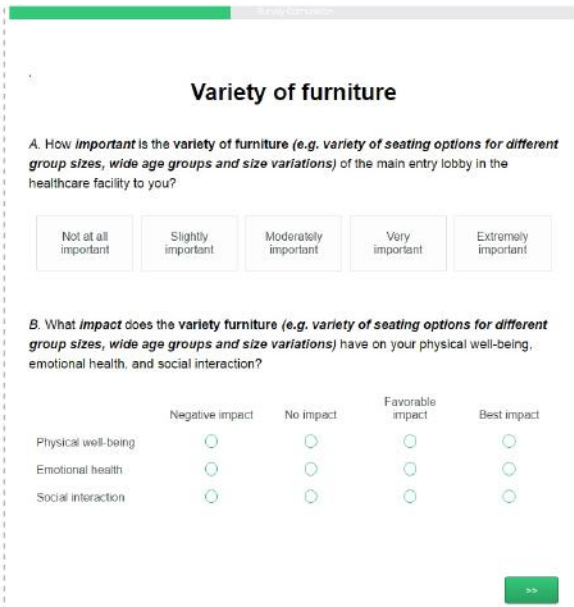
A. How ***important*** is the **environmental support for physical activities** ***(e.g. highly visible staircase, interior healing garden, meditation garden, indoor climbing wall, space for free body fat assessment)*** of the main entry lobby in the healthcare facility to you?

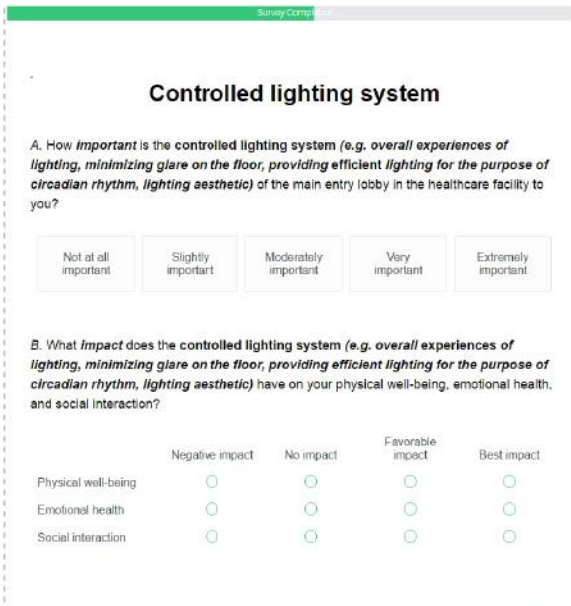
Not at all important	Slightly important	Moderately important	Very important	Extremely important

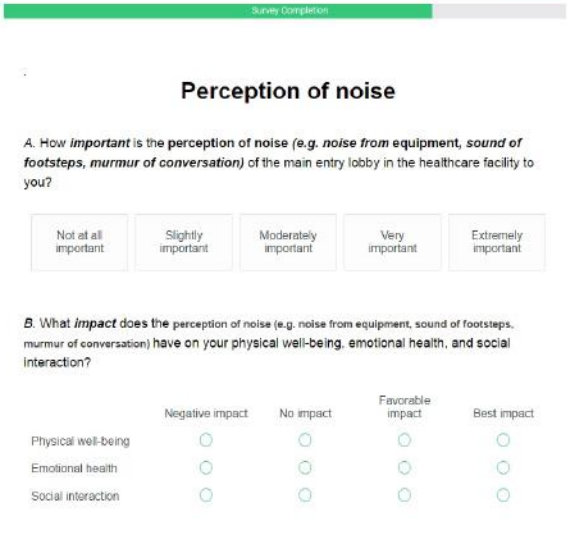
B. What ***impact*** does the **environmental support for physical activities** ***(e.g. highly visible staircase, interior healing garden, meditation garden, indoor climbing wall, space for free body fat assessment)*** have on your physical well-being, emotional health, and social interaction?

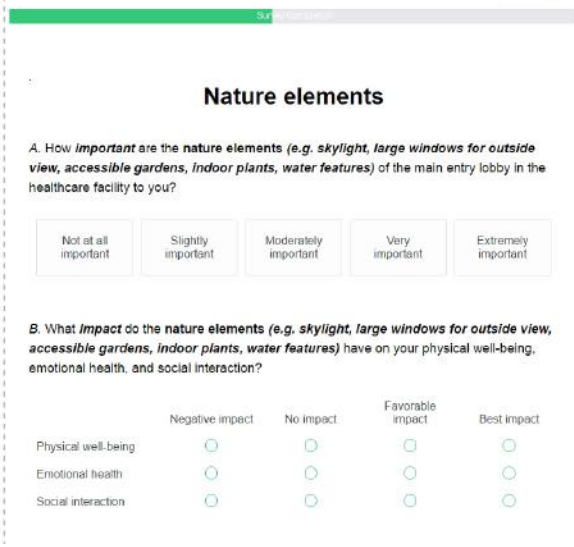
	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

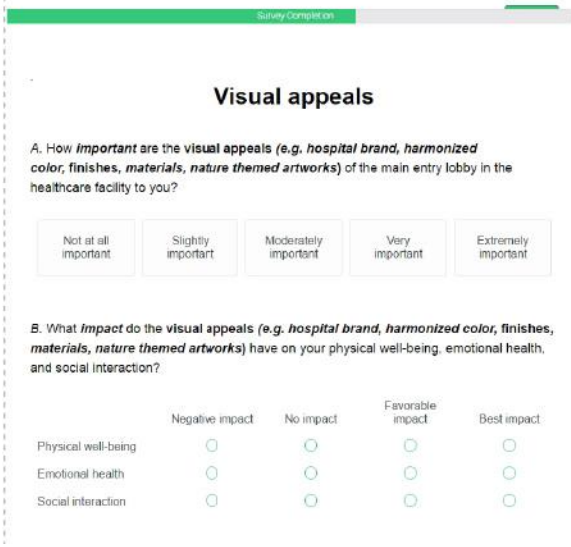

Survey Completion
Visual and auditory privacy
A. How important is the visual and auditory privacy (e.g. barriers in seating, privacy screens on registration area and/or kiosks) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact does the visual and auditory privacy (e.g. barriers in seating, privacy screens on registration area and/or kiosks) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction
>>


Variety of furniture
A. How important is the variety of furniture (e.g. variety of seating options for different group sizes, wide age groups and size variations) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact does the variety furniture (e.g. variety of seating options for different group sizes, wide age groups and size variations) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction
>>


Controlled lighting system
A. How important is the controlled lighting system (e.g. overall experiences of lighting, minimizing glare on the floor, providing efficient lighting for the purpose of circadian rhythm, lighting aesthetic) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact does the controlled lighting system (e.g. overall experiences of lighting, minimizing glare on the floor, providing efficient lighting for the purpose of circadian rhythm, lighting aesthetic) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction


Survey Completion
Perception of noise
A. How important is the perception of noise (e.g. noise from equipment, sound of footsteps, murmur of conversation) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact does the perception of noise (e.g. noise from equipment, sound of footsteps, murmur of conversation) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction


Nature elements
A. How important are the nature elements (e.g. skylight, large windows for outside view, accessible gardens, indoor plants, water features) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact do the nature elements (e.g. skylight, large windows for outside view, accessible gardens, indoor plants, water features) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction


Visual appeals
A. How important are the visual appeals (e.g. hospital brand, harmonized color, finishes, materials, nature themed artworks) of the main entry lobby in the healthcare facility to you?
Not at all important
Slightly important
Moderately important
Very important
Extremely important
B. What impact do the visual appeals (e.g. hospital brand, harmonized color, finishes, materials, nature themed artworks) have on your physical well-being, emotional health, and social interaction?
Negative impact
No impact
Favorable impact
Best impact
Physical well-being
Emotional health
Social interaction

Survey Completion

Positive distractions of sound

A. How ***important*** are the **positive distractions of sound** ***(e.g. white noise, access to soothing music, nature sound such as from water feature, or interior healing garden)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** do the **positive distractions of sound** ***(e.g. white noise, access to soothing music, nature sound such as from water feature, or interior healing garden)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Favorable impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

Survey Completion

User controlled environment

A. How ***important*** is the **user controlled environment** ***(e.g. adjustable furniture, adequate storage space for personal belongings, manual shading system)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** does the **user controlled environment** ***(e.g. adjustable furniture, adequate storage space for personal belongings, manual shading system)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Good impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

Survey Completion

Infection control

A. How ***important*** is the **infection control** ***(e.g. plenty of sinks and/or alcohol gel dispensers in visible and accessible locations, separated area for infectious visitors, visual cues as reminders for hand washing/ sanitation)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** does the **infection control** ***(e.g. plenty of sinks and/or alcohol gel dispensers in visible and accessible locations, separated area for infectious visitors, visual cues as reminders for hand washing/ sanitation)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Good impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

>>

Survey Completion

Air comfort and freshness

A. How ***important*** is the **air comfort and freshness** ***(e.g. comfortable air temperature, relative humidity, and flow speed, no unpleasant smell, air quality and freshness, appropriate temperature in season)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** does the **air comfort and freshness** ***(e.g. comfortable air temperature, relative humidity, and flow speed, no unpleasant smell, air quality and freshness, appropriate temperature in season)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Good impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Survey Completion

Cleanliness and maintenance

A. How ***important*** is the **cleanliness and maintenance** ***(e.g. cleanliness of overall waiting area, quility of maintenance, public restroom experience)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. What ***impact*** does the **cleanliness and maintenance** ***(e.g. cleanliness of overall waiting area, quility of maintenance, public restroom experience)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Good impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Survey Completion

Providing information for healthier life

A. How ***important*** is the **information for healthier life** ***(e.g. brochures, or pamphlets that address the benefits of health eating, overweight, or obese, nutritional information for foods and beverages sold in vending area, local farmers' market information)*** of the main entry lobby in the healthcare facility to you?

Not at all important	Slightly important	Moderately important	Very important	Extremely important

B. How impact does the **information for healthier life** ***(e.g. brochures, or pamphlets that address the benefits of health eating, overweight, or obese, nutritional information for foods and beverages sold in vending area, local farmers' market information)*** have on your physical well-being, emotional health, and social interaction?

	Negative impact	No impact	Good impact	Best impact
Physical well-being	○	○	○	○
Emotional health	○	○	○	○
Social interaction	○	○	○	○

Survey Completion

DEMO-1. Please select your gender.

- Male
- Female

DEMO-2. Please select your level of education where you were in Spring semester 2016.

- Undergraduate student (Bachelor level)
- Graduate student (Master level)
- Post-graduate student (Doctoral level)
- Not a student

DEMO-3. Are you a domestic, or an international student?

- Domestic student
- International student
- Not a student

DEMO-4. Which college are/ were you in?

- Agricultural and life sciences
- Business
- Design
- Engineering
- Human Sciences
- Liberal arts & sciences
- Veterinary medicine
- Other

Survey Completion

DEMO-1. Please select your gender.

- Male
- Female

DEMO-2. Please select your highest level of education attained

- Less than high school
- High school graduate
- Some college
- 2 year degree
- 4 year degree
- Professional degree
- Doctorate

DEMO-3. Are you in design / non-design background?

- Design background
- Non-design background
- Do not answer

Survey Completion

Last. Thank you so much for completing this survey. This is the last step for the survey. You have the opportunity to enter a drawing for one of five **$25 Amazon gift cards**. If you write your **email** address in the text box. If you **feel** uncomfortable to enter you email address in the drawing, you can write just N/A. This step is optional.

>>

Survey Completion

We thank you for your time spent taking this survey.
Your response has been recorded.

APPENDIX D

CONTENT ANALYSIS RESULTS

Category number	Major category	Specific criteria	Wellness design criteria	Design features
PRPOE-01	Reduce patient pain, stress, anxiety, and delirium	Patient has access to views of nature	2. Positive distractions	06. natural elements
PRPOE-02		Nature-themed artwork	2. Positive distractions	08. visual appeals
PRPOE-03		Access to music	2. Positive distractions	10. positive sound distractions
PRPOE-04		Physical environment is visually appealing	2. Positive distractions	08. visual appeals
PRPOE-05		Large windows for natural daylight and window views	2. Positive distractions	06. natural elements
PRPOE-06		Presence of clock and watch for patient's orientation with time	1. Experiences	04. additional space program
PRPOE-07		Presence of clock and watch for patient's orientation with time	2. Positive distractions	09. perception of noise
PRPOE-08		Use of white noise/sound masking to reduce disruptions from noise	2. Positive distractions	10. positive sound distractions,
PRPOE-09		Lighting design that allows lighting variation for the purpose of maintaining patients' circadian rhythm	2. Positive distractions	07. controlled lighting system
PRPOE-10	Improve comfort	Ventilation and air conditioning system accommodating temperature differences during seasons	2. Positive distractions	11. air comfort and freshness
PRPOE-11		Glare sources controlled to minimize patient discomfort	2. Positive distractions	07. controlled lighting system
PRPOE-12		Furniture suitable for wide age and size variations	4. Social support	17. variety of furniture
PRPOE-13		Amenities as considered appropriate, such as power outlets, wireless connection, phones	1. Experiences	04. additional space program
PRPOE-14	Reduce noise	Use of acoustic tiles	2. Positive distractions	09. perception of noise
PRPOE-15		Sound-absorbing construction and finish	2. Positive distractions	09. perception of noise
PRPOE-16	Respect privacy	Technology to filter/mask external noise such as white noise machine	2. Positive distractions	09. perception of noise
PRPOE-17		Furniture configured to allow patient and family privacy	3. Control	13. visual and auditory privacy
PRPOE-18		Minimum perceived visibility from public areas	3. Control	13. visual and auditory privacy
PRPOE-19	Improve patient satisfaction	Flexible patient room layout accommodating care activities when patient needs change	3. Control	14. user controlled environments
PRPOE-20		Glare controlled	2. Positive distractions	07. controlled lighting system
PRPOE-21	Enable & Enhance patient sense of control	Patient has control over the environment, without compromising safety	3. Control	14. user controlled environments
PRPOE-22		Adequate space for storage of personal belongings	3. Control	14. user controlled environments

PRPOE-23	Increase patient engagement	Design supports interaction between patients and staff	4. Social support	16. space configuration
PRPOE-24		Patient access to electronic media for education and entertainment	1. Experiences	04. additional space program
PRPOE-25		Access to family areas outside of patient room	1. Experiences	04. basic space program
PRPOE-26		Wireless connectivity/ Cellphone access	1. Experiences	04. additional space program
PRPOE-27		Comfortable and flexible accommodation for families to rest or lie down	1. Experiences	04. basic space program
PRPOE-28	Reduce risk of contamination	Smooth surface, with minimal perforations and crevices	5. Safety and security	19. cleanness and maintenance
PRPOE-29		Minimal ridges or reveals that could serve as dust collectors	5. Safety and security	19. cleanness and maintenance
PRPOE-30		Furniture is easy to clean and maintain	5. Safety and security	19. cleanness and maintenance
PRPOE-31	Improve hand sanitation	Visual cues as reminders for hand washing/ sanitization	5. Safety and security	20. infection control system
PRPOE-32		Sinks and alcohol gel dispensers in visible and accessible locations	5. Safety and security	20. infection control system

Category number	**Major category**	**Specific criteria**	**Wellness design criteria**	**Design features**
CDPOE-01	Enhance Privacy	Audio barriers at the registration	3. Control	13. visual and auditory privacy
CDPOE-02		Visual barriers between seating	3. Control	13. visual and auditory privacy
CDPOE-03		Sound masking - White noise and/ or music	2. Positive distractions	09. perception of noise
CDPOE-04		Privacy screens on registration kiosks	3. Control	13. visual and auditory privacy
CDPOE-05	Enhance waiting experience	Air temperature, relative humidity, and flow speed are comfortable	2. Positive distractions	11. air comfort and freshness
CDPOE-06		Attractive/inviting color/ materials	2. Positive distractions	08. visual appeals
CDPOE-07		Drinking water is easily accessible to all users	1. Experiences	04. additional space program
CDPOE-08		Hard toys and books are available for children of different ages	1. Experiences	04. additional space program
CDPOE-09		There is no unpleasant smell	2. Positive distractions	11. air comfort and freshness
CDPOE-10		Information regarding waiting time/time	1. Experiences	04. additional space program
CDPOE-11		Windows and/or skylight provide plenty of direct or indirect natural light	2. Positive distractions	06. natural elements
CDPOE-12		Furniture is easy to be adjusted to improve the comfort of various users	3. Control	14. user controlled environments
CDPOE-13		Size/layout to accommodate for different group sizes	4. Social support	17. variety of furniture
CDPOE-14		Cleanness of the space	5. Safety and security	19. cleanness and maintenance
CDPOE-15	Reduce patient anxiety	Noise-reduction - sound-absorbing materials	2. Positive distractions	09. perception of noise
CDPOE-16		Indoor plants, outside nature/gardens, artwork, or other pleasant stimuli are visible for users	2. Positive distractions	06. natural elements
CDPOE-17		Soothing music and nature sound are accessible to patients	2. Positive distractions	10. positive sound distractions,
CDPOE-		Weather protection - exit is well covered,	2. Positive	11. air comfort

18		protecting patients from weather	distractions	and freshness
CDPOE-19	Improve access and wayfinding	Clear physical boundary - waiting/ registration area, main circulation hallway	1. Experiences	04. basic space program
CDPOE-20		Kiosks for information or registration are available	1. Experiences	04. additional space program
CDPOE-21		Clear signage - location, languages, symbols are easily understandable	1. Experiences	06. accessibility to other space
CDPOE-22		Connection to parking - walk less than 3 minutes	G1. Experiences	01. entrance experience
CDPOE-23		Provide maps(floor plans) of the clinic are easy to understand	1. Experiences	06. accessibility to other space
CDPOE-24	Incorporate state-of-art technology	Enough spaces are available to accommodate kiosks or other displays for information access	1. Experiences	04. additional space program
CDPOE-25		Easy access to internet through wireless connection	1. Experiences	04. additional space program
CDPOE-26	Reduce patient infection risk	Easy to clean hard toys	5. Safety and security	19. cleanness and maintenance
CDPOE-27		Plenty of sinks and/or alcohol gel dispensers are located	5. Safety and security	20. infection control system
CDPOE-28		Separation or isolation of infectious patients	5. Safety and security	20. infection control system
CDPOE-29	Enhance security (patient staff facility)	Appropriate access control system prevents unauthorized entry in to patient interaction space	5. Safety and security	03. access control system
CDPOE-30		Protection devices, or safeguard staff in registration office	5. Safety and security	03. access control system
CDPOE-31		Exit doors are automatically closed, and equipped with alarms	5. Safety and security	03. access control system
CDPOE-32		All public areas and the entrances are visible to staff members located in the registration	5. Safety and security	03. access control system

Category number	**Major category**	**Specific criteria**	**Wellness design criteria**	**Design features**
GDCHF-01	Public and administrative areas	Public areas shall provide vehicular drop-off and pedestrian entrance, lobby, public toilet rooms	1. Experiences	02. entry vestibule experience
GDCHF-02		Lobby shall include a counter or desk for reception and information, public waiting area, public toilet facilities, access to make local phone calls, provision for drinking water	1. Experiences	04. basic space program
GDCHF-03		Provide enclosed vending area	1. Experiences	04. additional space program
GDCHF-04		Wheelchair storage area - provided out of the path of traffic	1. Experiences	02. entry vestibule experience
GDCHF-05		Convenience store, gift shop	1. Experiences	06. accessibility to other space
GDCHF-06	Functional program	Layout/ operational planning-enhance the satisfaction of users	1. Experiences	04. basic space program
GDCHF-07		Light and views - use of natural light, illumination, and views in the physical environment	2. Positive distractions	06. natural elements
GDCHF-08		Provide a garden or other controlled exterior space that is accessible to building users	2. Positive distractions	06. natural elements
GDCHF-09		Indirect lighting should be considered to reduce glare	2. Positive distractions	07. controlled lighting system
GDCHF-10		Clarity of access (wayfinding) - clearly visible and understandable signage, symbols, landmarks	1. Experiences	06. accessibility to other space
GDCHF-11		A system of interior "landmarks" should be developed to aid users in cognitive understanding of destinations (water feature, major art, distinctive color)	1. Experiences	06. accessibility to other space

GDCHF-12		Minimize site exterior noise method	2. Positive distractions	09. perception of noise
GDCHF-13		Keep speech privacy in open-plan spaces	3. Control	13. visual and auditory privacy
GDCHF-14		Waiting areas for patients on stretchers should be located in a private zone	1. Experiences	02. entry vestibule experience
GDCHF-15		Noise should be minimized be the design the physical environment	2. Positive distractions	09. perception of noise
GDCHF-16		Public circulation and staff/patient circulation should be separated wherever possible	1. Experiences	04. basic space program
GDCHF-17		Adequate exterior lighting in parking lots and entry points to the facility and appropriate reception/ security services are essential	5. Safety and security	03. access control system

Category number	Major category	Specific criteria	Wellness design criteria	Design features
LEED+HC-01	Sustainable sites	Development density and community connectivity	1. Experiences	04. additional space program
LEED+HC-02		Bicycle storage and changing rooms	1. Experiences	01. entrance experience
LEED+HC-03		Place of respite	3. Control	14. user controlled environments
LEED+HC-04		Direct exterior access for patients	1. Experiences	06. accessibility to other space,
LEED+HC-05	Indoor environmental quality	Thermal comfort - design and verification	2. Positive distractions	11. air comfort and freshness
LEED+HC-06		Daylight and views - daylight	2. Positive distractions	06. natural elements
LEED+HC-07		Daylight and views - views	2. Positive distractions	06. natural elements

Category number	Major category	Specific criteria	Wellness design criteria	Design features
BOSSA-01	Indoor air quality	Air movement	2. Positive distractions	11. air comfort and freshness
BOSSA-02		Humidity	2. Positive distractions	11. air comfort and freshness
BOSSA-03		Air freshness	2. Positive distractions	11. air comfort and freshness
BOSSA-04		Air quality	2. Positive distractions	11. air comfort and freshness
BOSSA-05	Noise distraction and privacy	Unwanted interruption	3. Control	13. visual and auditory privacy
BOSSA-06		Visual privacy	3. Control	13. visual and auditory privacy
BOSSA-07		Sound privacy	3. Control	13. visual and auditory privacy
BOSSA-08	Thermal comfort	Temperature in winter	2. Positive distractions	11. air comfort and freshness
BOSSA-09		Temperature in summer	2. Positive distractions	11. air comfort and freshness
BOSSA-10	Connection to outdoor environment	External view	2. Positive distractions	06. natural elements
BOSSA-11		Access to daylight	2. Positive distractions	06. natural elements
BOSSA-12		Connection to outdoors	1. Experiences	06. accessibility to other space,

BOSSA-13	Visual comfort	Lighting	2. Positive distractions	07. controlled lighting system
BOSSA-14		Personal control shading	3. Control	14. user controlled environments
BOSSA-15	Personal control	Degree of freedom to adapt	3. Control	14. user controlled environments
BOSSA-16	Spatial comfort	Comfort of furnishing	4. Social support	17. variety of furniture
BOSSA-17		Space for breaks	3. Control	14. user controlled environments
BOSSA-18		Interaction with colleagues	4. Social support	16. space configuration
BOSSA-19		Space for collaborate	4. Social support	16. space configuration
BOSSA-20	Building image and maintenance	Building aesthetics	2. Positive distractions	08. visual appeals
BOSSA-21		Cleanness and Maintenance	5. Safety and security	19. cleanness and maintenance

Category number	Major category	Specific criteria	Wellness design criteria	Design features
CWHSC-01	Nutrition	A written policy or formal communication that makes healthier food and beverage choices available in cafeterias, snack bars	3. Control	15. information for healthier life
CWHSC-02		A written policy or formal communication that makes healthier food and beverage choices available in vending machines	3. Control	15. information for healthier life
CWHSC-03		Provide nutritional information for foods and beverages sold in worksite cafeterias?	3. Control	15. information for healthier life
CWHSC-04		Make most of the food and beverage choices available in cafeterias be healthier food item?	3. Control	15. information for healthier life
CWHSC-05		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the benefits of health eating?	3. Control	15. information for healthier life
CWHSC-06		Provide a series of educational seminars, workshops, or classes on nutrition?	1. Experiences	04. additional space program
CWHSC-07		Offer or promote an on-site or nearby farmers' market where fresh fruits and vegetables are sold?	3. Control	15. information for healthier life
CWHSC-08	Physical Activity	Provide environmental supports for recreation or physical activity	3. Control	12. environmental support for physical activities
CWHSC-09		Provide an exercise facility on-site	1. Experiences	06. accessibility to other space
CWHSC-10		Post signs at elevators, stairwell entrances or exits and other key location that encourage employees to use stairs?	3. Control	12. environmental support for physical activities
CWHSC-11		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the benefits of physical activity?	3. Control	12. environmental support for physical activities
CWHSC-12	Weight Management	Provide free or subsidized body composition measurement, such as height and weight BMI	3. Control	12. environmental

		score, other body fat assessment followed by directed feedback and clinical referral when appropriate?		support for physical activities
CWHSC-13		Provide brochures, videos, posters, pamphlets, newsletters, or other written or online information that address the risks of overweight or obesity?	3. Control	12. environmental support for physical activities
CWHSC-14		Provide a series of educational seminars, workshops, or classes on weight management?	3. Control	15. information for healthier life
CWHSC-15		Provide free or subsidized one-on-one or group lifestyle counseling for employees who are overweight or obese?	3. Control	15. information for healthier life
CWHSC-16		Provide dedicated space that is quiet where employees can engage in relaxation activities, such as deep breathing exercises?	3. Control	14. user controlled environments

APPENDIX E

DATA CODING FOR ANALYSIS

Survey questions with answers and their recoded values

VPQ1.) Please, choose one of the types of healthcare facilities where you are familiar and have more experience than others.

a. Hospital (General, small primary care hospitals, critical access hospital, psychiatric hospital, rehabilitation hospital, etc.) (1)

b. Ambulatory care facility (Outpatient facility, Primary care outpatient center, small primary care, outpatient facility, freestanding outpatient diagnostic and treatment facility, urgent care facility, freestanding cancer treatment facilities, outpatient surgical facility, etc.) (2)

c. Residential healthcare facility (Nursing facilities, hospice facilities, assisted living facility, etc.) (3)

d. Other healthcare facility (Mobile, Transportable units, freestanding birth centers, adult day healthcare facilities, etc.) (4)

VPQ2 How often did you visit the type healthcare facility you chose in the previous question in last one year?

a. Less often than once a year (1)

b. Once or twice a year (2)

c. Once in three months (3)

d. Once a month (4)

e. Twice a month (5)

f. Once a week (6)

g. Twice a week (7)

h. More than four times a week (8)

i. Every day/ multiple times a day (9)

VPQ3. How long did you stay the healthcare facility in average in a visit?

a. Less than 1 hour (1)

b. 1 ~ 2 hours (2)

c. 2 ~ 4 hours (3)

d. 4 ~ 6 hours (4)

e. 6 ~ 8 hours (5)

f. All day (6)

g. Do not know (7)

VPQ4. What was the main purpose of your visit?

a. as a patient (1)

b. as a visitor (2)

c. as a volunteer (3)

d. as a staff (4)

Q1 ~ Q20. How important are the design feature (examples) of the main entry lobby in the healthcare facility to you?

a. Not at all important (1)

b. Slightly important (2)

c. Moderately important (3)

d. Very important (4)

e. Extremely important (5)

Q1A. ~ Q20A. What impact do the design feature (examples) have on your physical well-being?

a. Negative impact (1)

b. No impact (2)

c. Favorable impact (3)

d. Best impact (4)

Q1B ~ Q20B. What impact do the design feature (examples) have on your emotional health?

a. Negative impact (1)

b. No impact (2)

c. Favorable impact (3)

d. Best impact (4)

Q1C ~ Q20C. What impact do the design feature (examples) have on your social interaction?

a. Negative impact (1)

b. No impact (2)

c. Favorable impact (3)

d. Best impact (4)

DQ1 Please select your gender.

a. Male (1)

b. Female (2)

DQ2 Please select your level of education where you were in Spring semester 2016.

a. Undergraduate student (Bachelor level) (1)

b. Graduate student (Master level) (2)

c. Post-graduate student (Doctoral level) (2)

d. Not a student (3)

DQ3 Are you a domestic, or an international student?

a. Domestic student (1)

b. International student (2)

c. Not a student (3)

DQ4 Which college are/ were you in?

a. Agricultural and life sciences (2)

b. Business (2)

c. Design (1)

d. Engineering (2)

e. Human Sciences (2)

f. Liberal arts & sciences (2)

g. Veterinary medicine (2)

h. Other (2)

Table F. Coding Legend

Coding value	Description
VPQ(numeric value)	Visiting Pattern Question
Q(numeric value)	Main Question – importance of design feature
Q(numeric value)A	Main Question – impacts on participants' physical well-being
Q(numeric value)B	Main Question – impacts on participants' emotional health
Q(numeric value)C	Main Question – impacts on participants' social interaction
DM(numeric value)	Demographic question
(numeric value)	Value for IBM SPSS